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About the Journal

The Journal Of Contemporary Urban Affairs is dedicated to focuses on the socio-economic consequences of contemporary urbanization. In this regard, studies on conflict and divided territories, emerging cities, infra habitation, slums, affordable houses, gated communities, revitalization and rapid urbanization are the main socio-economic challenges in the contemporary urban spaces considered for publication in this journal. Recently, the editorial board of the journal have been added "Pandemic and its socio-economic consequences on cities" as additional scope to be considered for publication. Contributions are welcome from across the full range of social science disciplines and are expected to advance empirical and theoretical knowledge on contemporary urban affairs - by considering the main scopes of the journal - both from positive and normative perspectives. The highest priority is given to research reports that are specifically written for a multidisciplinary audience.

Journal of Contemporary Urban Affairs distinguishes itself by providing an international and interdisciplinary platform for the exchange of ideas and information among Architectures, urban planners, policymakers and urbanists from all disciplines to focus on seven main concerns of this journal which are Housing studies, Emerging cities, urban ecology, Infra Habitation, Revitalization strategies, conflict, divided territories and overall contemporary urban issues about mentioned concerns. Submissions of empirical, comparative, theoretical research, critical review and manifestoes for the future of cities from different scholarly disciplines and methodological perspectives are encouraged.

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EDITORIAL

The Journal Of Contemporary Urban Affairs is dedicated to focuses on the socio-economic consequences of contemporary urbanization. In this regard, studies on conflict and divided territories, emerging cities, infra habitation, slums, affordable houses, gated communities, revitalization and rapid urbanization are the main socio-economic challenges in the contemporary urban spaces considered for publication in this journal. Recently, the editorial board of the journal have been added "Pandemic and its socio-economic consequences on cities" as additional scope to be considered for publication. Contributions are welcome from across the full range of social science disciplines and are expected to advance empirical and theoretical knowledge on contemporary urban affairs - by considering the main scopes of the journal - both from positive and normative perspectives. The highest priority is given to research reports that are specifically written for a multidisciplinary audience.

Editorial Board strives to provide a possibility for the scientists of different fields to publish the results of their research, technical and theoretical studies. *Journal of Contemporary Urban Affairs* is multidisciplinary in approach and will publish a great range of papers: reports of qualitative case studies, quantitative experiments and surveys, mixed-method studies, action researches, meta-analyses, discussions of conceptual and methodological issues.

A broad outline of the journal's scope includes peer-reviewed original research articles, case and technical reports, reviews, short communications and notes to the editor. All scholars, practitioners, professionals, researchers and policymakers with a common interest to study in the field of architecture and urban design from different disciplines, such as Art, Architecture, Landscape, Urban Planning and Urban Design are welcome to share their research findings. The journal only publishes research of the highest quality and impact. All articles are published in English and undergo a peer-review process.

Educational Technology

Journal of Contemporary Urban Affairs has an international editorial board of eminent experts in their field from Turkey, USA, UK, Germany, India, Canada, New Zealand, Cyprus, Egypt, Malesia, Lebanon, Switzerland and Pakistan. We are confident that JCUA will attract a great number of editors, eminent scientists in the field. The selection will be based on the activities of the editors and their desire to contribute to the development of the journal. *Journal of Contemporary Urban Affairs* provides a platform for academics and scientists professionals to refer and discuss recent progress in the fields of their interests. Authors are encouraged to contribute articles that are not published or not under review in any other journal. Each submitted manuscript is evaluated based on the originality of its contribution to the field of scholarly publishing, the soundness of its theory and methodology, the coherence of its analysis and its availability to readers (grammar and style). The normal turn-around time for the evaluation of manuscripts is one to two months from the date of receipt.

Submission of an original manuscript to the journal will be taken to mean that it represents original work not previously published, that is not being considered elsewhere for publication; that the author is willing to assign the copyright to the journal as per a contract that will be sent to the author just before the publication and, if accepted, it will be published in print and online and it will not be published elsewhere in the same form, for commercial purposes, in any language, without the consent of the publisher. The names and email addresses entered in this journal site will be used exclusively for the stated purposes of this journal and will not be made available for any other purpose or to any other party. The requirement for the submission of a paper implies that it has not been published before; that it is not under consideration for publication anywhere else.

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Originality – The author should ensure that the manuscript has not been previously published nor is being considered by another journal.

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Writing – Please write in good English (American or British usage is accepted, but not a mixture of these). For non-native English speakers, and perhaps even for some native English speakers, grammar, spelling, usage, and punctuation of the

texts are very important for an effective presentation. Hence, manuscripts are expected to be written in a clear, cogent, and readily understandable by an international readership.

Manuscripts must be submitted online. Electronic submission reduces the editorial processing and reviewing time. As part of the submission process, authors are required to check off their submission compliance with all of the following items, and submissions may be returned to authors who do not adhere to the following guidelines:

-The submission has not been previously published or presented to another journal for consideration (or an explanation has been provided in Comments to the Editor).

-The submission file is in OpenOffice, Microsoft Word, RTF, or WordPerfect document file format.

-Where available, URLs for the references have been provided.

-Where available, DOI numbers for the references have been provided.

The text is single-spaced; uses a 12-point font; employs italics, rather than underlining (except with URL addresses); and all illustrations, figures, and tables are placed within the text at the appropriate points, rather than at the end. The text adheres to the stylistic and bibliographic requirements outlined in the Author Guidelines. If submitting to a peer-reviewed section of the journal, the instructions in *Ensuring a Blind Review* have been followed.

A manuscript goes through the peer-review process. Authors submit manuscripts to Editorial office via the online system. The acknowledgement letter should be sent to the author to confirm the receipt of the manuscript. The Chief Editor first reviews manuscripts. Chief Editor is assisted by Section Editors (could also be Co- or Associate Editors). The Editor assigns a Section Editor to see the manuscript through the complete review process and return it with a recommendation or decision. The manuscript is checked to see if it meets the scope of the Journal and its formal requirements. If it is incorrect or unsuitable, the author should be informed and the manuscript filed (or returned if requested) – direct rejection. Manuscripts that are not suitable for publication in the Journal are rejected. A Rejection letter is sent to the author stating the reason for rejection. If the manuscript conforms to the aims and scope of the Journal and formally abides by the Instructions to Authors it is sent out for review. Depending on the type of paper, it could be accepted immediately for publication (invited Editorial, Book review etc) by the Chief Editor. Check that the manuscript has been written and styled in accordance with the Journal style; that it carries an abstract (if applicable), keywords, correct reference system etc. and check that the correct blinding system has been used. If anything is missing, Editor in Chief through the associate editor will ask the authors to complete it before the manuscript is sent out for review. The manuscript is sent out for review. The reviewer reads and evaluates the manuscript and eventually sends a review report to the Chief Editor. The time for review can be set to 2-6 weeks depending on the discipline (more time is usually given to papers in the humanities and social sciences). Make sure to provide the reviewer with clear instructions for the work, e.g., outlined in the form of a Review report or several questions to be considered. Based on the reviewers' comments the Chief Editor decides to:

-Accept the manuscript without further revision

-Accept after revision

-Ask authors to resubmit

-Reject

An acceptance letter is sent to the author and the final manuscript is forwarded to production. Sometimes, the authors are requested to revise in accordance with reviewers' comments and submit the updated version or their manuscript to the Chief Editor. The time for review can be set to 2-6 weeks depending on the discipline and type of additional data, information or argument required. The authors are requested to make substantial revisions to their manuscripts and resubmit for a new evaluation. A rejection letter is sent to the author and the manuscript is archived. Reviewers might be informed about the decision. After review, a manuscript goes to the Copy Editor who will correct the manuscript concerning the correct referencing system, confirmation with the journal style and layout. When Copy Editor finishes his/her work they send manuscripts to the Layout editor. Layout Editor is responsible for structuring the original manuscript, including figures and tables, into an article, activating necessary links and preparing the manuscript in the various formats, in our case PDF and HTML format. When Layout Editor finishes his/her job they send manuscripts to Proof Editor. Proof Editor confirms that the manuscript has gone through all the stages and can be published.

This issue on education has 9 articles. The editors seek to publish articles considering socio-economic consequences of contemporary urbanization in the specific field of Housing Studies, Emerging Cities, Urban Ecology, Infra Habitation, Revitalization Strategies, Conflict, Divided Territories; they are looking forward to substantial improvement of educational processes and outcomes.

With kind regards,

Dr. Hourakhsh A. Nia
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Original scientific paper

Urban Acupuncture in Large Cities: Filtering Framework to Select Sensitive Urban Spots in Riyadh for Effective Urban Renewal

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ABSTRACT

New revitalization and regeneration strategies are currently taking place as a scheme for reassessing urban spaces. This paper, as a result, navigates the theory of Urban Acupuncture (UA) as a quick and effective tool that can be adopted in large cities. Using Riyadh city as a case study, it discusses how this tool can be used to achieve maximum results with minimal effort in the most critical places. Riyadh city is the capital of Saudi Arabia and is considered one of the fastest-growing metropolitan cities in the Arab world. Through time, it has transformed into a city with leftover open spaces and an ever-increasing population. The study commences by exploring the term UA and its principles and similarly presents some of its successful international examples. It thereafter delves into the past and current situation in the city to show some of the challenges it faces. The study aims to develop a filtering framework for selecting a suitable sensitive spot that can be used to apply the concept of UA. A conclusion is made that as a small-scale space approach and a progressive concentrated urban renewal strategy.

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1. Introduction

Urban areas are currently experiencing rapid population growth rates. It has, therefore, become a necessity to use creative and innovative strategies to cope with the challenges that may occasion from this growth. Considering what the world is currently going through regarding the COVID-19 pandemic, there is a need to pursue strategies that would quickly and efficiently address such emerging challenges (Casagrande, 2020). From the foregoing, the traditional strategic urban development plans whose scope usually

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covers a macro scale might not provide a suitable path for addressing such challenges. This is because there is now a great demand for a much faster approach that may be used to address these challenges at a micro level, consequently creating a healthier environment particularly in the most needed areas (Lastra & Pojani, 2018). This paper, therefore, seeks to explore the use of UA as an effective and shortest way of promoting urban development in large cities. The intention is to reduce urban inflation in addition to restoring the green environment by dealing with leftover open spaces individually within the urban tissue. It also seeks to develop a comprehensive framework that would facilitate the application of UA as a tool for guiding the selection of the most urgent spots in the city fabric that need to be developed. A literature review is also undertaken to account for the difference between large- and small-scale urban renewal strategies and UA strategy in addition to defining the UA approach with its principles and strategies. The paper further presents the following two international examples drawn from Egypt and Indonesia to demonstrate the different strategies used.

- Upgrading of a slum area in Kampung Jakarta, Indonesia (Nurdiansyah, 2018).
- Pedestrian Passage in Downtown Cairo, Egypt (Tang et al., 2015).

Major Arab cities have experienced a rapid growth rate in recent years which has dramatically changed land use and old urban fabric. Riyadh is one of the cities that has rapidly expanded on account of industrialization and population increase. For instance, in 1862, it had 7500 people (Palgrave, 1868) and was projected in 2010 to reach 6,152,899 (Abderrahman, 2000). The city was for that reason selected to study and extract the filtration framework due to its fast-urban growth rate that is elicited by different development patterns. The study ends by presenting the conclusion and recommendations that cover the following:

- Recommendation on UA approach implementation.
- Future urban development for Riyadh, and how UA can be used with the other urban development strategies.
- Proposed future studies to deal with the ongoing urban issues in cities.

Figure 1 shows the structure of the research. The aim is to reach the desired filtration framework that applies UA theory.

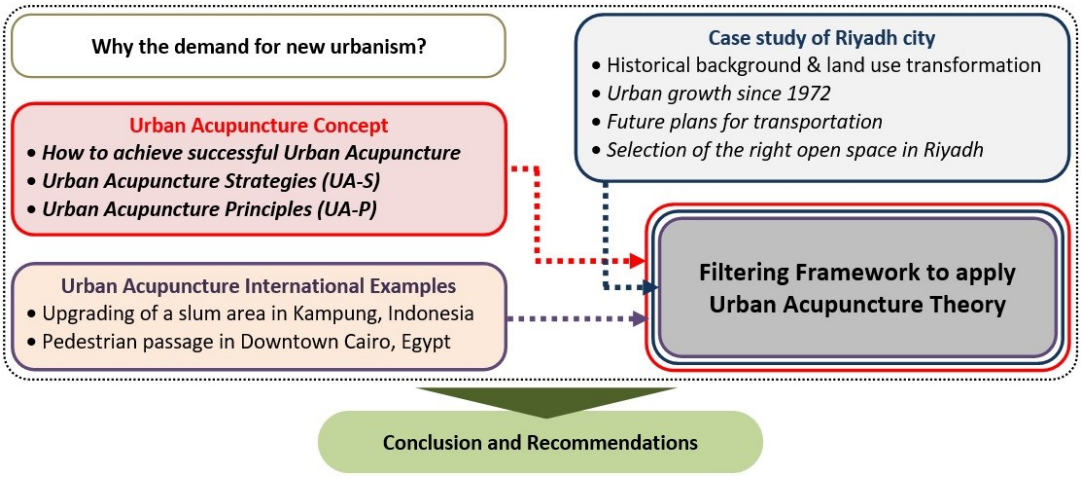


Figure 1. Structure of the research.

2. Why the Demand for a New Urbanism?

Several urban planners, such as Christopher Alexander, Allan Jacobs, and Lewis Mumford have stressed the importance of open spaces in urban areas. They highlighted the major contribution of public spaces to quality of life and how it contributes to urban image and economic development (Shidan & Qian, 2011). The development strategies of public open spaces in the twentieth century were mostly large in scale with an overview vision of all the city, which is not efficient and desirable with the quickly accelerating pace of the surrounding environment (Ellin, 2007).

The demand for a new tool of urbanism started to arise in recent decades. De Meulder stated in his book, *Urban Trialogues*, that with all the

fast growth and complexity of cities at the moment, changing development conditions, and dramatic shifts in urban situations in the societies, it seems to be clear that the traditional approach of master planning and static land use distribution is not sufficient to achieve sustainable and comprehensive urban development (De Meulder et al., 2004).
In European countries, some plans to develop urban areas were large in scale, and the revitalisation of every neighbourhood was usually made by governments at a local level, which proved to not be a suitable approach compared to pinpointing the local problems of each area (Lastra & Pojani, 2018). On the other hand, in 2007, the Netherlands had forty neighbourhoods known for having a lot of problems and dysfunctions. The government's approach to solving the problem was to spotlight the potential in each neighbourhood and start separate action plans for development instead of making a general vision (Permentier et al., 2013).
The case of a Seattle neighbourhood in the USA is another model of how the local community found a unique approach for developing opportunities for their urban spaces when the community members built up a small movie theatre to replace an unused car parking laneway (Wolfe, 2011). The evidence above indicates that UA as a new way to deal with open spaces on a smaller scale has been becoming more desirable than a top-to-bottom urban vision.

3. Urban Acupuncture Concept

Thinking of a city as a living organism is an approach to understanding the urban environment as a dynamic accumulative process. A successful city must, therefore, have the ability to understand and interact with the inhabitants to solve its difficulties (Jacobs, 2002). In this approach of understanding, UA has been defined as a kind of surgery performed in a city (Ellin, 2007). The term UA went through various steps from its initial concept, developing through time. The concept was first conceived by the Barcelona urbanist, Manuel de Solà-Morales, as the urgent need to achieve urban development projects in a short period and have the maximum effect on Barcelona city revitalisation in the 1980s (Degen & Garcia, 2012). The purpose was to develop the city by implementing small urban projects in residential neighbourhoods (Marzi & Ancona, 2004).

3.1 Urban Acupuncture vs. other renewal strategies

UA aims to have an impact on every potential space in the city. It can be applied through art—sometimes, it is called the 'true art of our urban context' (Lerner, 2016). That is why it is different from the large urban renewal strategy that has been previously used; it is a localised, small-scale intervention method. Because this approach should be influenced by the local inhabitants, it must be raised from the smallest-scale urban city development (Marzi & Ancona, 2004; Harjoko, 2009a). Table 1 illustrates the comparison between UA, small- and large-scale urban renewal strategies.

Table 1. Comparison between UA, Large and Small-Scale Urban Renewal.

Comparison Items	Various Types of Urban Renewal		
	Large-Scale Urban Renewal	Small-Scale Urban Renewal	Urban Acupuncture
Aim of Development	*Achieve mostly financial profit*	*Improve the environment and living conditions*	*Solve different urban problems (social, environmental, etc.)*
Director of Development	*Government and developers*	*Government and residents*	*Government, developers, and local community*
Development Method	*Mostly to demolish and reconstruct all at one time*	*Achieve goal in stages progressively*	*The accumulative effect, step by step*
Funding	*One-time investment from government or developers*	*From government and residents' funds*	*Various/unlimited channels*

Comparison Items	Various Types of Urban Renewal		
	Large-Scale Urban Renewal	Small-Scale Urban Renewal	Urban Acupuncture
Strategy: Planning and design	*From top to bottom*	*From top to bottom*	*From top to bottom*
Strategy: Construction	*From top to bottom*	*From bottom to top*	*From bottom to top*
The difficulty of Strategy Application	*Simple*	*Flexible*	*Flexible*
Level of Urban Development	*One-time improvement*	*Step-by-step improvement*	*Step-by-step improvement*
Preserving Local style and Historical Context	*The small level of preservation with a large level of demolition*	*A small level of preservation with a small level of demolition*	*A balanced level of preservation*
Economic Land Use Benefit	*High*	*Low*	*High*
Sustainability and Ongoing Development	*Low*	*Moderate*	*High*

3.2 How to achieve a successful UA Strategy

To choose the best successful strategy in UA, two important criteria must be achieved. The first one is the quality and effectiveness of the urban catalyst and mixed-use areas; the second is to choose the best sensitive spot.

3.2.1 Urban catalyst effectiveness and mixed-use

The most effective catalyst for UA must be related to ecological, economic, and social factors (Jackson, 2018). From an architectural point of view, any successful building must stimulate economic and social activities and be within walking distance of other activities (Rosa-Jiménez et al., 2017). Hence, it is more effective to select areas with more mixed uses and different types of recreational facilities.

3.2.2 Selection of the best sensitive spot

Like the human body, each place in a city has certain linkages to other places. Space most frequently linked with other spots is the most suitable spot for the needle of UA. With this ability, like stem cells in a human body, UA would improve the whole structure of the city (Apostolou, 2015).

UA theory has a more effective impact when applied to human-centred open spaces, where the spaces are more walkable, safe, accessible, and sociable. Thus, it is better to choose this approach for small, leftover, neglected spaces in the urban fabric, not for well-designed, large open spaces or parks. As shown in Table 2, the concept of human-oriented spaces can be categorised as follows:

- Spatial aspects that relate to spatial forms of space.
- Socio-spatial aspects, which involve the relation between users and open space.

Table 2. Different aspects of human-centred public open spaces.

	Aspects	Explanation
Spatial aspects	Walkable	Enhances pedestrian-friendly activity and ease of navigation for people walking through (Ewing and Handy, 2009).
	Safe	Offers protection from traffic movement and crime, increasing the feeling of safety (Gehl and Lars, 2008).
	Accessible	Easy to access and move around during all the times of the day (Varna, 2014; Mehta, 2014).
	Comfortable	Offers different kinds of activities to practice, either when standing or sitting (Casagrande, 2020).
	Delightful	Has special elements of aesthetic value in a human-scale environment (Kamel et al., 2017).

Socio-spatial aspects	Inclusive	Encourages all types of activities; welcoming and inviting (Madanipour, 2010).
	Sociable	Enhances social-user interaction for both active and passive types (Carmona et al., 2010).
	Liveable	Well used and busy all day long for both day and night activities (Gehl and Lars, 2008).

3.3 Urban Acupuncture Strategies (UA-S)

From the literature review on UA, the research will draw a conclusion in reference to the strategies that have been used mostly to develop small urban spaces (Messeter, 2015; Apostolou, 2015; Houghton et al., 2015; Lastra & Pojani, 2018; Casagrande, 2020). The different UA strategies can be listed as follows:

UA-S01 *Use existing resources*

It is important to recognise each neighbourhood's resources and use them in the best way by utilising direct local citizen participation to achieve this.

UA-S02 *Redefinition of aesthetic urban elements*

Urban features show the identity of the street, and open-space furniture should connect with the personality of each space individually in an aesthetic way.

UA-S03 *Achieve diversity and inclusivity*

Promote the presence of diversity and establish the connection between residents yet allow each one to express his taste.

UA-S04 *Increase visibility of public buildings*

Stress visually on important public buildings' entrances through different colours and unique vegetation (Rosa-Jiménez et al., 2017).

UA-S05 *Open space redefinition*

Understand the vital role that open space plays and increase its potential to form positive events in daily lives.

UA-S06 *Reuse and recycling of resources*

The word "recycling" has become especially important in every contemporary design of open space; it is a step to redefine the space as a living hybrid.

UA-S07 *Confirm the sentimental value of vegetation*

Improve the relationship between the local citizen and the natural environment; promote diversity in vegetation according to each site's identity.

UA-S08 *Connectivity and graduate design*

Each intervention in this strategy should connect with the open space and work gradually from the highest interest to the edge.

UA-S09 *Adaptive and open design*

The design should be flexible and aim to promote an adaptive and open style; the level of interaction with local citizens will certainly be affected gradually.

UA-S10 *Shared management and responsibility*

Empower local users and the neighbourhood to the extent that management systems of public space must ensure their inputs over time.

3.4 Urban Acupuncture Principles (UA-P)

Most studies on UA indicate that no model or rule has applied the approach to the existing open city spaces. Instead, what exists is a group of principles set as a trial for possible use in future studies. Based on the literature review, this research will, therefore, conclude with a set of important principles that can be used to achieve the development of open city spaces through small-scale urban interventions. Figure 2 shows the principles of UA.

Figure 2. Urban Acupuncture Principles.

3.4.1 Sensitive spot selection (UP-P01)

Like in Chinese acupuncture therapy, locating the sensitive points in the human body is the first and most important step for treatment. This principle was first stated by De Solà-Morales in his book, *A matter of things* (De Solà-Morales, 2008). On the other hand, Lerner defines the sensitive point in the urban tissue as the place that lacks energy flow in a sick city (Lerner, 2016).

3.4.2 Small scale (UP-P02)

Every UA intervention must be applied to small-scale spaces, as this approach aims for a big impact with small pilot projects. De Solà-Morales mentioned that the scale is relative, and it does not only mean scale in size; it can also be applied to financial input or investment (De Solà-Morales, 2008).

3.4.3 Quick action plan (UP-P03)

While normal planning might take a while to design and implement, UA needs a quick action plan; Lerner refers to this as having a spark in our spaces and confirms that we don't have unlimited time to keep on planning and implementing (Lerner, 2016).

3.4.4 Having a scenario (UP-P04)

Lerner was the first to claim the necessity of having a scenario in any urban acupuncture development. He stated that every city development project would take three years to achieve, and to make it happen we would need to have a certain scenario with a design proposal and ideas (Lerner, 2016).

3.4.5 Educate people (UP-P05)

Like in placemaking, it is essential in the UA approach to understanding how the built environment has been received by its society. The people's knowledge and understanding of urban intervention accelerate the possibility of success (Nurdiansyah, 2018).

3.4.6 Citizen participation (UP-P06)

The decision-makers are not the only sources of design proposal—the people themselves take the lead in the UA approach. Citizen participation will lead the planner to a whole new vision of development, as the planner does not have the right answers for every problem (Stupar & Savcic, 2009).

3.5 Principles (UA-P) vs Strategies (UA-S)

Though the UA principles mentioned above are a must for every project, each principle can be achieved through many strategies. Hence, principles are mandatory to be accomplished, while strategies are different according to each location's potential. Figure 3 describes how each principle can be accomplished through two or more strategies.

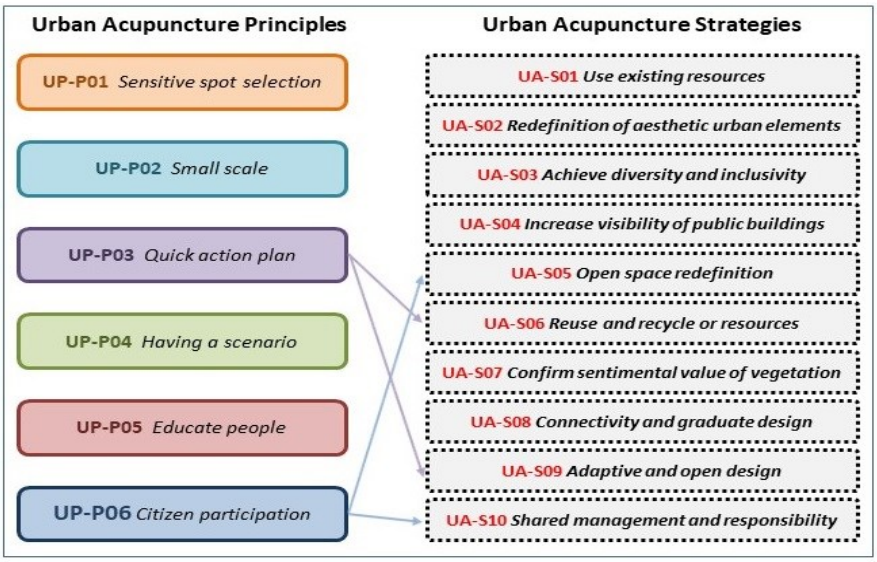


Figure 3. Urban Acupuncture Principles *vs* Strategies.

4. Urban Acupuncture International Examples

In this section, the paper introduces two successful projects that have applied the principles of UA. These selected projects will be presented and evaluated according to the different strategies mentioned earlier. Table 3 shows the selected case studies, their locations, and years of implementation.

Table 3. Locations of selected international examples of Urban Acupuncture.

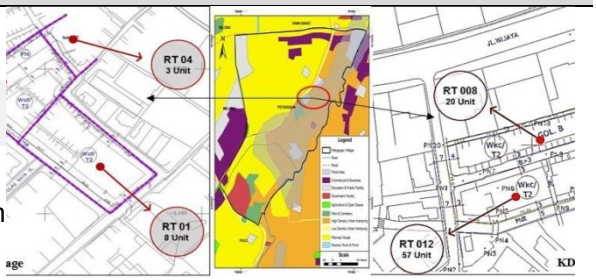
No.	Year	Project name	Location	Level of Acupuncture
1	2016	Upgrading of a slum area in Kampung	*Jakarta, Indonesia*	*Buildings and Space*
2	2015	Pedestrian Passage in Downtown Cairo	*Cairo, Egypt*	*Street*

4.1 Upgrading of a slum area in Kampung, Indonesia

Jakarta has had massive expansion that has led to urban slum problems, especially in urban Kampung (Nurdiansyah, 2018). Kampung is largely inhabited by poor people who are mainly migrants, lacking work skills and who are in dire need of affordable housing (Harjoko, 2009b). The government had, therefore, to respond to this demand by offering affordable housing and urban spaces (Harjoko, 2009a). Table 4 shows the project information and location.

Table 4. Kampung Neighbourhood Upgrading project.

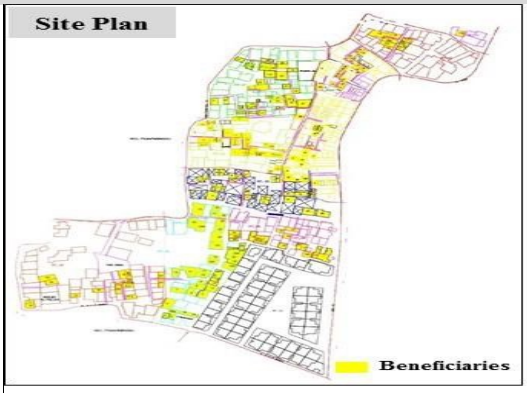
Project Information	
Type of project	Affordable housing project
Project scale	*Buildings and Space*
Main concept	To create affordable housing buildings with surrounding urban green spaces



(Nurdiansyah, 2018)

Project Description

- The implementation of the upgrading project was finished by the government of Jakarta in 2016.
- Some of the poor residents (beneficiaries) in the area have been moved to the newly designed area.
- The project succeeded in improving the quality of housing in the neighbourhood.
- The area became healthier and cleaner from the improved quality of living and green areas.
- The level of participation and responsibility of the individual residents increased a lot during and after the project implementation.



(Nurdiansyah, 2018)

Development vision

4.2 Pedestrian Passage in Downtown Cairo, Egypt

Downtown Cairo has been the city's centre of attention since 1992. There had been many trials for preserving its historic buildings and developing the open space network (Nassar, 2015b; Kamel et al., 2017). Most of the previous efforts, both academic and governmental, were related to documenting historical heritage (Elsorady, 2018). Recently, the private company, Al Ismailia for Real Estate Investment, attempted to develop the area by preserving its heritage buildings and creating dynamic urban fabric through small interventions in certain spots (Tang et al., 2015). According to Nassar, most people were using spaces in Downtown Cairo for social and cultural events by day and social gatherings by night (Nassar, 2014a). Later, after the 2011 revolution, it was notable, not only in Downtown Cairo, but across all the city that people had started to gather and socialise in many physical forms in the streets and spaces, engaging in many types of activities, like street performance, festivals, art fairs, and graffiti (Tang et al., 2015). The selected Passage in Downtown Cairo is one of the important destinations for small-scale gatherings because of its central location and variety of adjacent services. In this context, the Kodak Pedestrian passage between buildings was carried out by CLUSTER as a pilot project to engage the local community after it had been isolated for many years (CLUSTER, 2015).

Table 5. Pedestrian streetscape passage in Downtown Cairo.

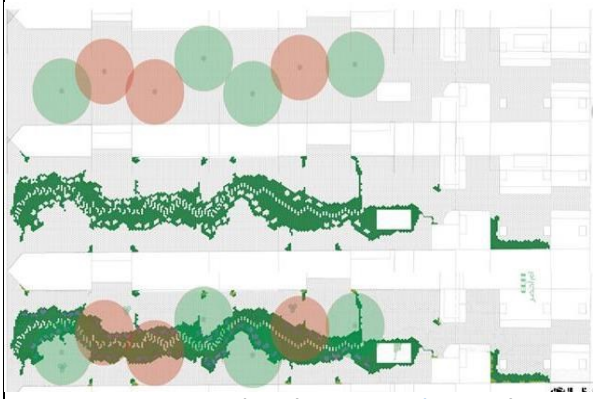
Project Information	
Type of project	Streetscape development
Project Scale	*Street*
Main concept	The purpose was to reuse the street as an open exhibition to attract different types of artists and cultural events and create a hub for pedestrians to socialize.

Site Location in Downtown Cairo

Project Description

The development project of the downtown passage mission aimed to achieve four main aspects:

- Establish a suitable platform for culture, integrating outdoor art and green areas.
- Create a network hub that would attract different stakeholders to participate with the local community.
- Make open space more accessible and create a more suitable environment for diverse activities.
- Use a variety of approaches to power the informal practices to create a more intimate space with the participation and management of inhabitants.



Street Design (Tang et al., 2015)

Development vision	  (Tang et al., 2015)

4.3 Summary of international examples

The results of analysing the two international examples of UA are presented in Table 6. The main conclusions can be listed as:

- The project in Cairo successfully applied most of UA strategies, which supported the success of the pilot project and allowed it to become a gathering hub for different types of users.
- The different scales of the two projects illustrate that the smaller the project was, the easier it was to apply more strategies and engage the local community more in the design and management processes.

Table 6. UA strategies in international examples.

		 *Indonesia*	 *Egypt*	International Examples	
				Upgrading of a slum area in Kampung, Indonesia	*Pedestrian Passage in Downtown Cairo, Egypt*
Urban Acupuncture Strategies	UA-S01 *Use existing resources*			√	√
	UA-S02 *Redefinition of urban aesthetic elements*				√
	UA-S03 *Achieve diversity and inclusivity*			√	√
	UA-S04 *Increase visibility of public buildings*				√
	UA-S05 *Open space redefinition*				√
	UA-S06 *Reuse and recycle resources*			√	
	UA-S07 *Confirm the sentimental value of vegetation*				
	UA-S08 *Connectivity and graduate design*				√
	UA-S09 *Adaptive and open design*			√	√
	UA-S10 *Shared management and responsibility*			√	

5. Case Study of Riyadh City

Riyadh city is the capital of KSA. It started as a small gated city and developed rapidly into a liveable metropolitan city over the years. This massive change happened during the period of the oil boom (1970-1990). Its rapid from a pedestrian-friendly environment into a car-oriented city was not an easy evolution but a dramatic change full of conflicts and urban problems along the way (Menoret, 2014). Figure 4 shows the location of the city.

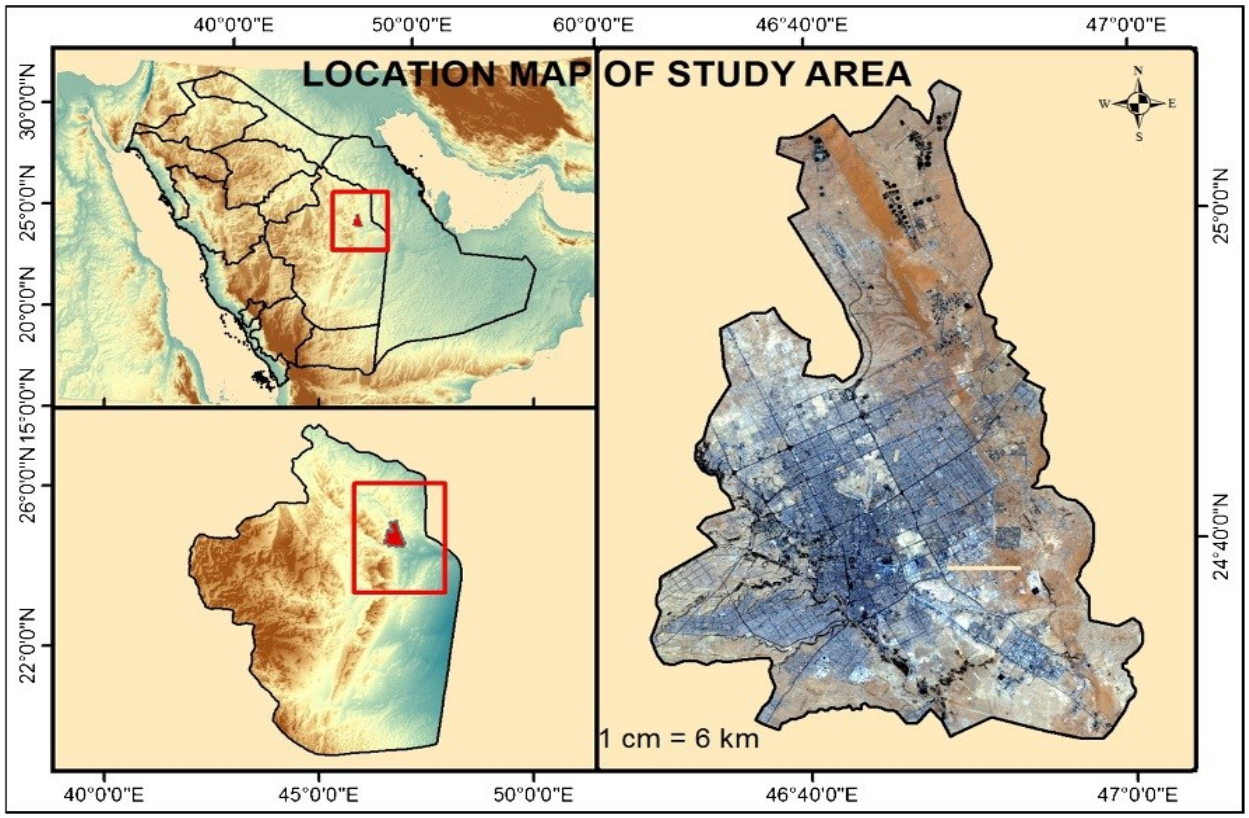


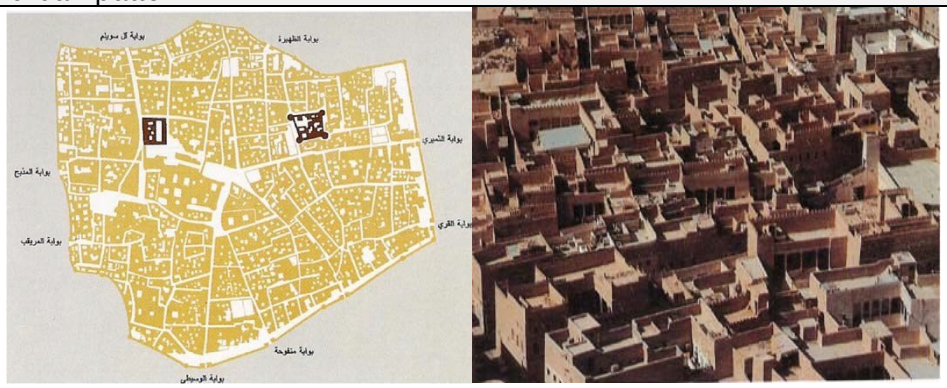
Figure 4. The study area of Riyadh city (Khan et al., 2018)

5.1 Historical background and land use transformation

The city of Riyadh is a centre of vibrant urban activity in the KSA, working as a link between the eastern and western metropolitan areas to form a crossing axis in the country (Al-Hemaidi, 2001). During the oil boom stage of development, the city was expanding at 8% per annum. The population surpassed one million by the 1980s, and the city covered almost 1600 km^2 in 1986 (Mubarak, 2004). Today, the population has reached 6 million (Almahmood et al., 2018). Table 7 illustrates the two significant urban patterns developed in the city, which can be explained as follows:

- The old walled city, which is a traditional old community with narrow streets and high dependency on pedestrian movement (Almahmood et al., 2018).
- The grid street pattern, which has a new land use transformation of both housing types (Separated Villas) and larger road width and open space network accessed only by cars (Menoret, 2014).

Table 7. Historical development of Riyadh.

Pattern Type	
	Traditional urban pattern
	 The urban pattern of the traditional walled town of Riyadh (Mubarak, 2004).
	New street pattern
	 A new street pattern in Riyadh city, Al-Malaz (Al-Hathloul, 1981).

5.2 Urban growth since 1972

Most of the development plans made for the city adopted the car as the main mode of transportation. Hence, the street patterns for the city were designed in a hierarchical way, which included freeways and ring roads to connect all of the city with other regions in the kingdom, going low until reaching arterial streets that serve inside each neighbourhood (Al-Hathloul & Mughol, 2004). Nowadays, the old traditional fabric of the city is in poor condition. Through the urban growth shown in Figure 5, there is a new network of roads that were laid out to facilitate car movement (Alotaibi & Potoglou, 2018). Meanwhile, the spatial arrangement and the old open spaces network in traditional areas in Riyadh have been affected badly. Figure 5 illustrates the high rate of expansion for the city from 1972 to 2015, which will affect plans and creates an urgent need for public transport to connect the city.

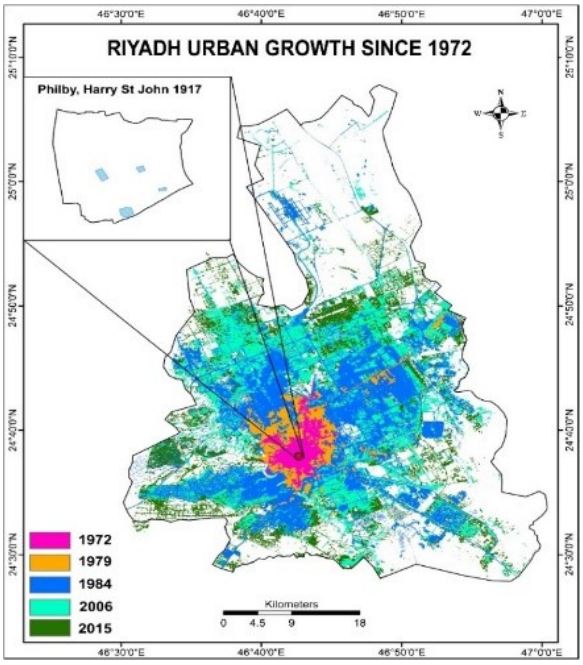


Figure 5. Urban growth in Riyadh city through time (1972–2015) (*Khan et al., 2018*)

5.3 Future Plans for Transportation

As mentioned before, the city has developed rapidly and has highly become car-oriented (Al-Hathloul, 2017). It, however, lacks the public transportation system needed to connect its areas, which certainly affects pedestrian connectivity and consequently creates isolated spaces or green areas, either big or small (Aldalbahi & Walker, 2016). Riyadh Development Authority developed a strategic development plan, Medstar (ADA, 2015), which identified some transport strategies in the city to include the following (Alotaibi & Potoglou, 2018):

- Developing an effective public transport network in the city.
- Coordinating between high-density residential areas and major public transport spines.
- Developing the management measures of roads, including road charging and congestion pricing.

Figure 6 shows the designed metro lines in the city that connects all the urban areas.

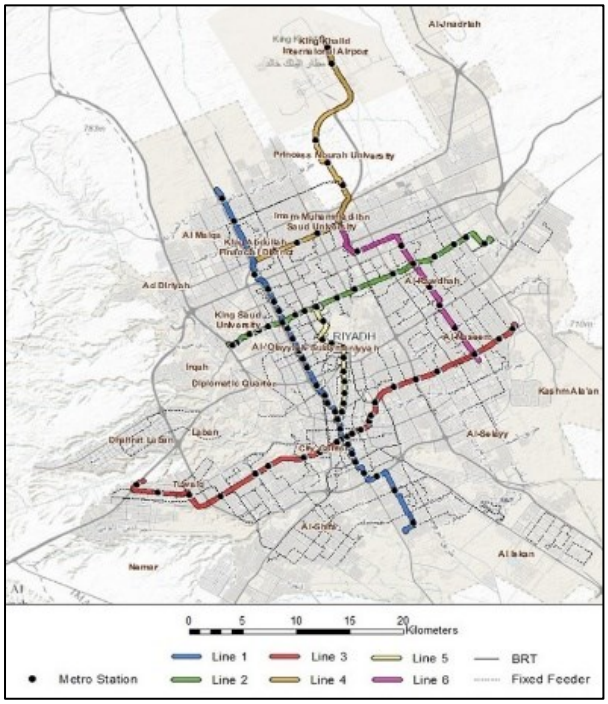


Figure 6. The planned public transport system in Riyadh - Metro Line (ADA, 2015).

5.4 Steps to select the right open space in Riyadh

To this point in the current research, an overview of the Riyadh city master plan is undertaken. This progressively narrows to a smaller focus until the best sensitive spot where the concept of UA can be applied in the urban fabric is identified. This process will be staged in three steps as follows:

- The first step—Selecting the best development centre
- Second step—Urban catalyst and mixed-use areas
- The third step—Selecting the sensitive spot

5.4.1 First step—Selecting the best development centre

The Riyadh Public Transport Network (RPTN) consists of the metro lines network and the bus lines, which are meant to connect all the urban areas. These lines are already under implementation and were expected to be delivered in late 2019 (Al-Hathloul, 2017). This network adapted the concept of Transit-Oriented Development in the city, and for the research limitation, the historic centre will be selected to choose from it a suitable open and green space where the concept of UA can be applied. Figure 7 shows the planned five transit-oriented development centres in Riyadh and the selected centre in the middle.

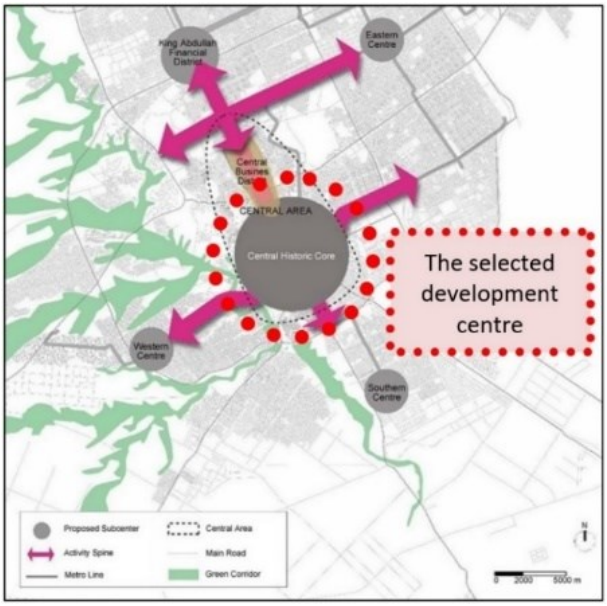
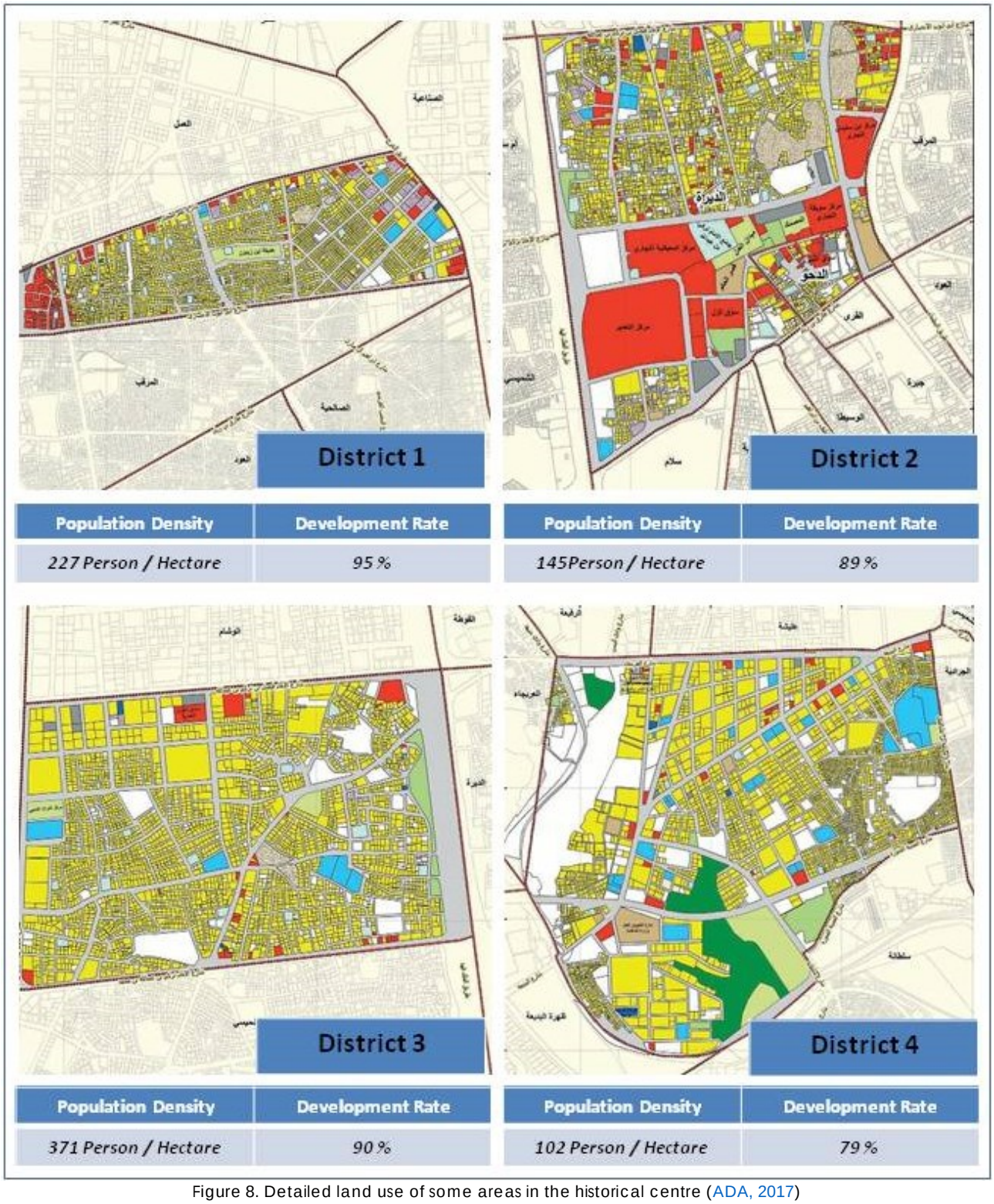


Figure 7. Transit-Oriented Development TOD strategy in the Riyadh metropolitan area (ADA, 2016).

5.4.2 Second step—Urban Catalyst and mixed-use areas

In this stage, the research navigates the land use in the selected historical centre, where four districts were selected randomly from highly mixed-use areas and evaluated to choose the most suitable one to study on an urban level. The best location to apply the UA approach will thereafter be picked. While Figure 8 illustrates

the detailed land use of these districts with their population densities and development rates (ADA, 2017), Table 8, on the other hand, evaluates the four districts from the development centre to provide the basis for picking the best site.



Population Density	Development Rate
227 Person / Hectare	95 %

Population Density	Development Rate
145Person / Hectare	89 %

Population Density	Development Rate
371 Person / Hectare	90 %

Population Density	Development Rate
102 Person / Hectare	79 %

Figure 8. Detailed land use of some areas in the historical centre (ADA, 2017)

Table 8. Evaluating the four districts to select the best one Selected Zones.

√	*High*				
	Moderate				
	Low				
					
		District 1	*District 2*	*District 3*	*District 4*
Evaluation Criteria	*Higher population density*			√	
	Lowest development rate				√
	Lowest open green spaces			√	
	Potentials of existing catalyst buildings		√		
	Most distributed mixed-use				√
	Most available public services	√			
	Street patterns encourage walkability			√	
	Highest violence and crime rate			√	

Source: Adapted by the author from ADA (2017) and RUO (2018).

As shown in the table above, the district that needs much development appears to be District 3, according to the criteria points which were derived from the literature review.

5.4.3 Third step—Selecting the sensitive spot

This stage focus on the selected district from where the appropriate space to develop will be chosen. The process will be performed according to the aspects presented in Table 2 highlighting the filters that should be used to choose the best human-centered open space. Figure 9 consequently shows the urban development pattern for District 3 which highlights the most sensitive spots that may be chosen to apply the concept of UA.

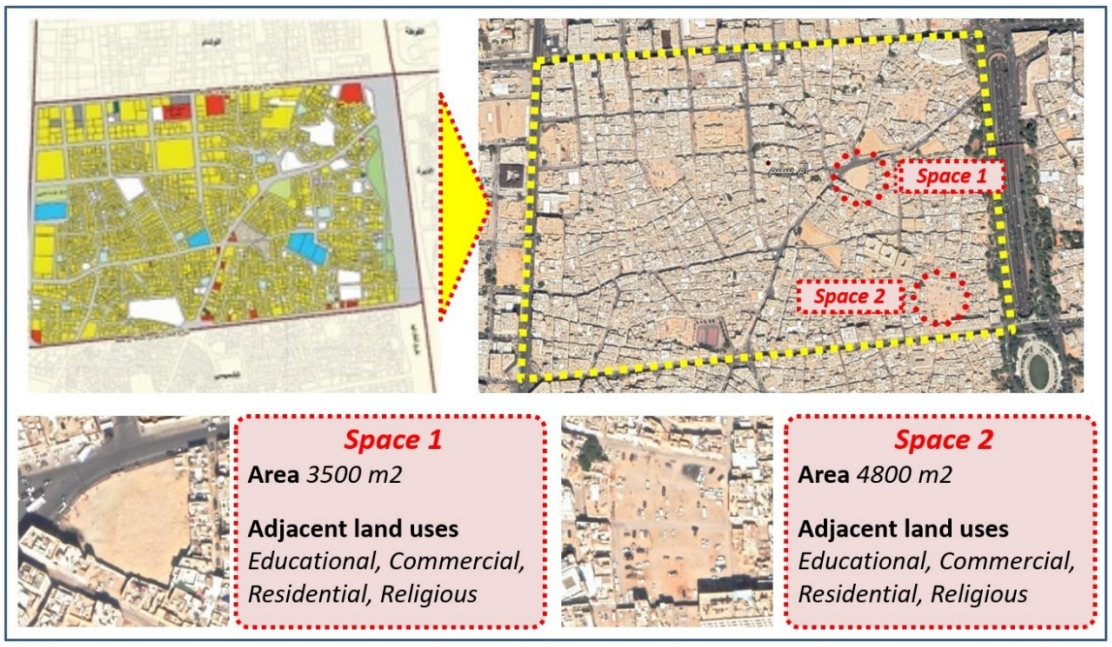


Figure 9. The urban street pattern for District 3 with the potential suitable sensitive spots to apply the UA concept.

6. Filtering framework to apply Urban Acupuncture Approach

After undertaking a literature review on the UA that included its principles and strategies, this section now concludes the filtering framework that may be applied to Riyadh city or any other place to select a suitable site where UA as a concept may be applied. Figure 10 presents a conclusion on the five filters.

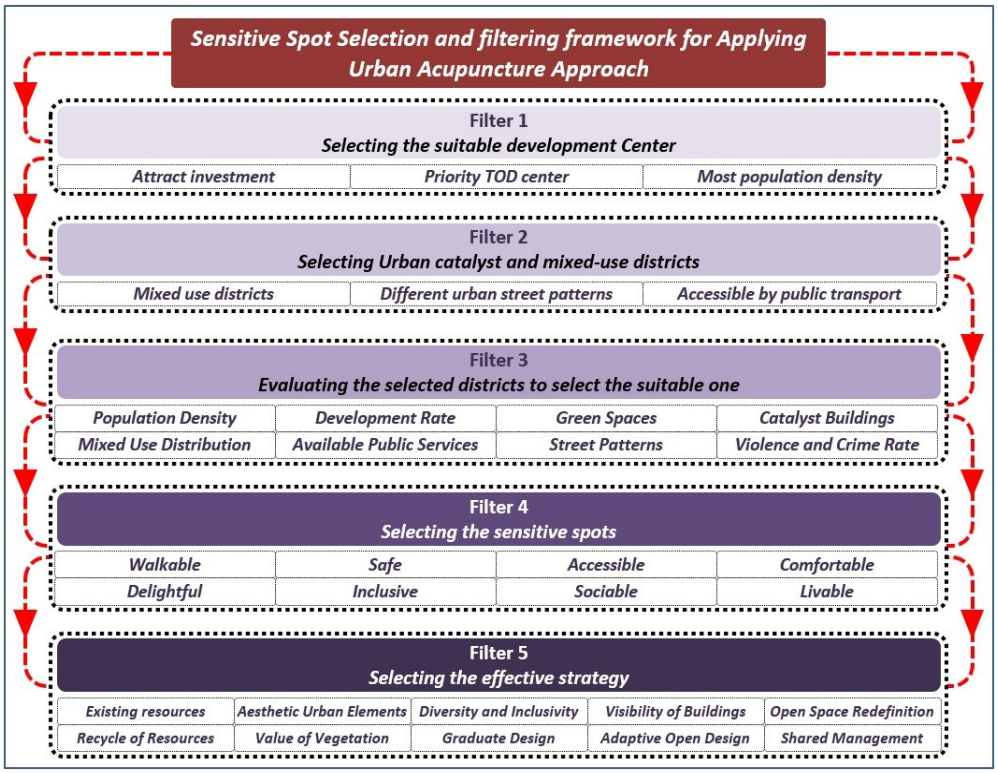


Figure 10. Sensitive spot selection and filtering framework for applying the UA approach.

7. Conclusions and Recommendations

This paper has examined the use of UA as an alternative tool for dealing with open spaces on a smaller scale. It also introduced the concept of evolutionary history and discussed how UA differs from other urban renewable strategies in addition to highlighting the applicable strategies and principles. The paper consequently examined the city of Riyadh as a case study for implementing UA and proposed a filtering selection framework that can be applied to select the suitable open spaces for adopting UA. The paper concludes that as a small-scale space approach and a progressive concentrated urban renewal strategy, UA enhances a city's potential rather than entirely relying on the urban planners' vision. In this way, the city's development remains healthier, effective, and sustainable. The selected international case studies further showed that the UA could be more effective on smaller-scale action projects where it can achieve a tremendous effect in a noticeably short time since it remains very flexible by encouraging ongoing planning and implementation. The research further concludes that the principles of UA should be examined in future studies with a focus on more practical research being undertaken in different locations by engaging all stakeholders in the development process.

As a recommendation, since the city of Riyadh shows the highest rate of urban expansion, there is a need to adopt the strategic urban development plans and localise small-scale space interactions to create a balance between the newly planned district and the old ones through UA. It is moreover important to change the existing social and cultural norms by frequently engaging the people through awareness in creating a better environment as one of the important principles of UA. Finally, since the city of Riyadh has a mixture of newly planned and large old historical fabric, a different development approach should be adopted for each of the two regarding the urban fabric and socio-cultural composition of the residents.

Finally, considering the world is going through the COVID-19 pandemic and that most of the affected districts have the highest population density with no green lung or development projects, the concept of green roofs in buildings can, therefore, be a good approach to deal with the high-density district in Riyadh. This can be revitalized by selecting suitable spots that may be developed on a separate case-by-case basis.

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Conflict of interests
The author declares no conflict of interest.

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Mediterranean Morphologies in Hot Summer Conditions: Learning from France's "Glorious Thirty" Holiday Housing

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ABSTRACT

Climate change and rising temperatures lead to an air-conditioning proliferation in the summertime of the Mediterranean regions. This study links urban morphology to the microclimate. It claims that a lesson can be drawn from holiday housing morphologies designed with an additive approach during the "Glorious Thirty" French coastal development (1946-75). It is based on a morphological analysis of four case studies, with on the one hand re-drawing and site visiting, on the other hand, assessment of environmental performance through key parameters: Absolute Rugosity, Compactness Ratio, Building Density, Mineralization, Sky View Factor (SVF) and Height/Width (H/W) Ratio. Compared to literature reference values of a traditional courtyard morphology, the case studies are less compact and with a lower H/W Ratio (higher SVF), but they are less mineral than a historic medieval city centre. This research contributes to the search for semi-collective alternatives (for example additive morphologies) to individual housing in peri-urban areas, with high environmental performance in the summertime.

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1. Introduction

The "Glorious Thirty" - 1946 to 1975, a depiction of the thirty years of economic boom and the beginning of paid holidays for everyone denotes when mass tourism was born, consequently providing a huge demand for holiday housing on the Mediterranean coast.

It is a period of great excitement and experimentation leading to a "new" architecture occasioned by new technologies such as reinforced concrete, and by a reaction to the Modern Movement, the CIAM (Congrès International d'Architecture Moderne) and its

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functional city which is typified by standard mass housing and functional urban zoning (Duport, 2015). As a result, the Mediterranean Coast and this new program are used as an experimental laboratory by several avant-garde architects (some affiliated with Team X – the young generation of architects that organized the 10th CIAM congress). They intend to combine rational minimalist architecture (new technologies) with architecture in due consideration of the site and the environment (sun, wind, nature). They search for an architecture that repeats similar elements to facilitate construction and minimize costs and assemble housing types or units. This brings to the fore the concept of "*Additive architecture*" which, according to the words of Jørn Utzon (Lukovich, 2018) describes architectural projects based on growth patterns, through the assembly or addition of similar elements.

Several of those avant-garde architects from the "Glorious Thirty" mention the use of vernacular (mountain) villages as references for morphologies. For instance, J. Aubert and A. Lefèvre were inspired by Kabyle mountain villages. G. Candilis specifically quotes Avilcar in Cappadocia, Turkey. Consequently, based on the knowledge of vernacular architecture and personal intuition, additive morphologies are designed specifically for the summer.

> *Were they pursuing solely a non-monotonous image, by fear of mass production monotony? Or did they study the thermal functioning in the summer heat and apply their findings as design strategies*?

From the foregoing, the current study researches if the above morphologies are efficient in summer and how they react under hot summer conditions. This is because there is a nexus between urban morphology, urban microclimate, and energy use (Adolphe, 2001; Taleghani, et al., 2015). The reviewed literature, as a result, treats morphologic and geometric indicators to study this link (Adolphe, 2001). The current research, therefore, uses an integrative approach by simultaneously considering thermal and microclimatic functions, as in the case of Jamei, Rajagopalan, Seyedmahmoudian, and Jamei (2016) and Ratti, Raydan, and Steemers (2003). In this case, the retained indicators are Absolute Rugosity, Compactness Ratio, Building Density, Mineralization, Sky View Factor (SVF), and Height/Width Ratio. Further, many studies are based on what is known as "urban canyons", or a symmetrical section of a certain length (Oke, 1988). Unlike the current study, they mainly focus on urban city centres.

Although previous studies have been undertaken from a historic and an architectural point of view, their environmental functioning in the summertime is yet to be evaluated (technical and engineering point of view) hence a knowledge gap. The current research, therefore, focuses on this area since individual housing and sprawl are still prevailing in France's Mediterranean region because up till today, new individual housing is still in demand. The current study broadly contributes to the search for semi-collective alternatives (for example, additive architecture) to individual housing in peri-urban areas. The hypothesis is that these additive residences have a positive environmental performance during hot summer conditions, thus providing a certain cooling effect. The specific objectives are to assess the environmental performance of four additive morphologies, to compare them, and finally to relate them with the results of the literature review. As this is done, the "urban canyon" approach, that evokes city centres is applied to peri-urban additive morphologies.

2. Materials and Methods

Four case studies in Mediterranean France have been undertaken, all avant-garde manifestations of a reaction to the Modern Movement: additive architecture, designed with the environment. The case studies were re-drawn using Archicad software, based on cadaster plans, architects' plans, and aerial pictures. This information was completed with on-site fieldwork. The drawings and 3D models were used for morphology analysis and parameter quantification. Comparison to research reference values allowed environmental assessment. To give a "complete" environmental assessment, there were parameters related to all four climatic aspects: wind, temperature, humidity, and solar radiation (Adolphe, 2001). Although street Orientation and Porosity are also key parameters, they were not examined in this paper since their method of quantification was not satisfactory.

Rugosity describes how the wind is influenced by obstacles. "*The higher the* rugosity, *the*

slower the main airspeed." (Adolphe, 2001). Absolute Rugosity is the mean height of the urban canopy, with built and non-built areas (Table 1), and indicates why wind speed reduces owing to morphology. As observed by Oke (1988), though wind disperses heat, too much of it can create a need for shelter. This study assumes that more wind contributes to an increased cooling effect in hot summer conditions.

The Compactness Ratio, on the other hand, reveals how much envelope area is exposed to the outside environment. It is an indicator of potential exchange between the building and the environment (Table 1). The lower the ratio, the less the heat loss (winter) and gain (summer), and the better in hot summer conditions (Ratti et al., 2003).

Mineralization is the ratio of Mineral Area to Total Area (Table 1) (Adolphe, 2001). Vegetation has a cooling effect due to evapo-perspiration (impacting humidity) and shading (protection from solar radiation) (Adolphe, 2001; Jamei et al., 2016). Green and blue areas were therefore traced from the aerial pictures. Literature shows that the shading effect is more important than the evapo-perspiration effect (Ali-Toudert & Mayer, 2007). It is therefore important to consider trees as well as green surfaces. In this regard, all green surfaces were traced. These included: lawns, hedges, trees, private and public green. Generally, the greener the surface (and the lower mineralization), the more cooling in hot summer conditions.

The Sky View Factor (SVF) is a dimensionless parameter that expresses sky visibility in a street. It is the degree to which a wall is exposed to the sky, warming up due to solar radiation during the day, and cooling down at night (Oke, 1988). It ranges between 0 (closed section) and 1 (horizontal flat surface in complete sky contact). SVF can be measured with street view image methods, numerical models, and fisheye photo methods (Miao et al., 2020). This study uses the last. The photographs (obtained on the 13th of March 2020, in the afternoon, for the Ginestou and the Village Grec, and on the 27th-28th of February 2020 for Gaou Bénat and Merlier) were taken in street centres, at 30 cm high.

Through image treatment, the sky was represented in white, buildings and other obstructions, like vegetation, in black. The black and white treatment and the SVF calculation were undertaken using Rayman software. However, some images were pre-treated in Photoshop, since the software interpreted dark skies as walls and white walls as the sky. Analysis of the plans was additionally undertaken to determine typical street widths for each case study. SVF locations were chosen based on the observed widths, and indifferent height situations, that is two buildings of the same height or different heights, a building and a courtyard wall, two courtyard walls, among others. Another criterion was the search for the smallest SVF for every case study, based on intuition and street width. Squares were not considered. Even though this method does not cover the entire residence, it gives an overall image. The lower the SVF, the more protection against summer heat (Jamei et al., 2016; Ratti et al., 2003). As such, the streets remain cool for a longer time during the day. On the contrary, the higher the SVF, the easier the summer heat disappears during the night. For climates with high-temperature swings between day and night, low SVF is considered better for hot summer conditions.

The SVF and the H/W Ratio are inversely related (Oke, 1988). Since the additive '60s morphologies have very few symmetrical street sections, the H/W Ratio needs some extra attention. The height (H) is defined by the mean height of the elements visible in the SFV photograph (hedge, building, courtyard wall…). The street width (W), on the other hand, is between the defining height elements. Inversely to SVF, a higher H/W is considered better for hot summer conditions (Ali-Toudert & Mayer, 2006; Jamei et al., 2016).
Table 1 shows the parameters and their expression used for the environmental assessment.

Table 1. Parameters and their expression used for the environmental assessment.

Name	Definition	Units	ref
Absolute rugosity R	$R = \frac{V_b}{A_t}$	m	(Adolphe, 2001)
Compactness Ratio C_f	$C_f = \frac{1}{V_b}\sum_{i=1}^{n} S_{ei}$	-	(Ratti et al., 2003)
Building Density	$BD = \frac{A_b}{A_t}$	-	(Adolphe, 2001; Tadi et al., 2017)
Mineralization M	$M = \frac{1}{A_t}\left(A_t - \sum A_u\right)$	%	(Adolphe, 2001)

A_b Total area of the buildings' footprints (m²)
A_t Total area of the selected site (m²)
V_b Total volume of the built area (m³)
S_{ei} Envelope Surface of building i (m²): façades plus roofs, without underground and adjacent walls
A_u Water and Vegetation Area

3. Case Study Presentation

Occitanie's coast, on the Westside, was characterized by mosquito infestations, winds and wine culture. It was a rough 180km strip of sand that thousands of tourists passed every year on their way to Spain or Italy (Figure 1). To transform the region from pass-through to stay-in, the French government initiated its development into a mass tourism destination. A comprehensive undertaking, called *Mission Racine*, named after the project's coordinator, Pierre Racine, was consequently established for developing five villages and protected natural green zones between 1963 and 1983. The planning process went hand in hand with extensive sanitation, draining, and infrastructural works.

The Chief Architect, Georges Candilis, designed one of the villages, Leucate-Barcarès and two of the case studies (Village Grec and Ginestou). Although they are private property, they are connected to and part of the urban network which is accessible to everyone. To date, most of the houses are secondary holiday houses, but some of them are inhabited all year round. Leucate has a temperate Mediterranean climate, with warm hot summers (33,8°C in June), temperate winters (-1°C in January), and strong North-West winds during the summer months. Figure 1 presents the location of the case studies.

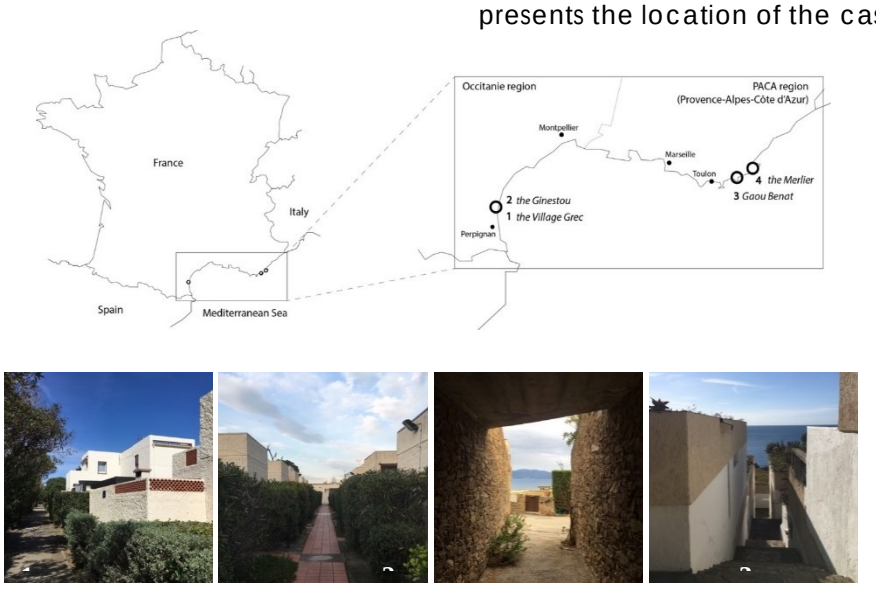


Figure 1. Case study location and photographs.
(1): Village Grec in Leucate; (2): Ginestou in Leucate;
(3): Gaou Benat in Bormes-les-Mimosas; and (4): Merlier in Ramatuelle

The Eastern part of the coast (PACA region) has a very different geography with rocky seashores and garrigue vegetation (scrubland). It has been developed mainly through private initiatives. The accent lay less on economic and low budget mass building. Currently, Gaou Benat and Merlier are two private residences, closed communities with a checkpoint at the entrance. Very few people live there all year round and the houses are mostly used as secondary residences (as holiday housing). PACA has a temperate Mediterranean climate as well, with warm hot summers (35°C in May) temperate winters (-2,8°C in December), and strong NNW, SE, and SW winds during the summer months.

All case studies, apart from the Ginestou, are labelled "Patrimoine du XXème siècle" (label of the Ministry of Culture and Communication for remarkable architecture in France) for their remarkable architectural value. Ginestou received the notion of "exceptional" architecture in a patrimony study of Leucate City.

3.1. Case Study 1: Village Grec, Leucate, 1968

Figure 2. Village Grec. Left: Ground floor with pedestrian street widths and SVF locations;
Middle: first floor
Right: schematic diagram of the assembled "T" units
Bottom: Section A.
Red line: mean building height; Blue line: Absolute Rugosity or mean urban canopy height

The village's morphology is created by assembling 53 T-shaped units with two courtyards: a small access court with the entrance door, and a large private courtyard, which is partially sheltered and only accessible from the inside (Figure 2). There is a second, larger, type of "T", with a first floor. Some small "T"'s has the first floors as well. All first floors (but one) are offset from the street, to capture the sun on street level. Units are grouped four by four, with a large "esplanade" in the middle. Missing or shifted units are green space, but only very few are accessible and real squares. The central esplanade is also only accessible on a walking path.
While cars stay in the common parking, pedestrians take the 3m wide streets or the 8 m wide "esplanade" (Figure 2). All streets are boarded by hedges from 1 to 3 m high on one or both sides. The overall impression is one of a small-scale village with plenty of green space. Despite the extremely regular road network, an irregular impression comes from different kinds and heights of courtyard walls and shelters, and the randomness of the first floors. It seemingly looks like Candilis' vernacular village reference. A specificity of this residence is the brick-on-the-side-walls: some walls have bricks with openings turned towards the streets and terraces. They are omnipresent: on every first-floor terrace or courtyard, sometimes near to the ground, sometimes up. They also protect from wind, but let air pass.

In a general way, G. Candilis was sensitive to bioclimatic approaches. This can be seen in his drawings and writings. When he is designing for Iran, for example, ventilation chimneys pop up, and in the tropics, ventilation takes the lead in ideas and drawings. So, in Leucate, he designed for the Mediterranean moderate climate, integrating courtyards, shutters and shelters (for solar protection), hedges and trees (for shade and coolness), small pedestrian passages and accessible rooftop terraces.

3.2. Case Study 2: Ginestou, Leucate, 1963

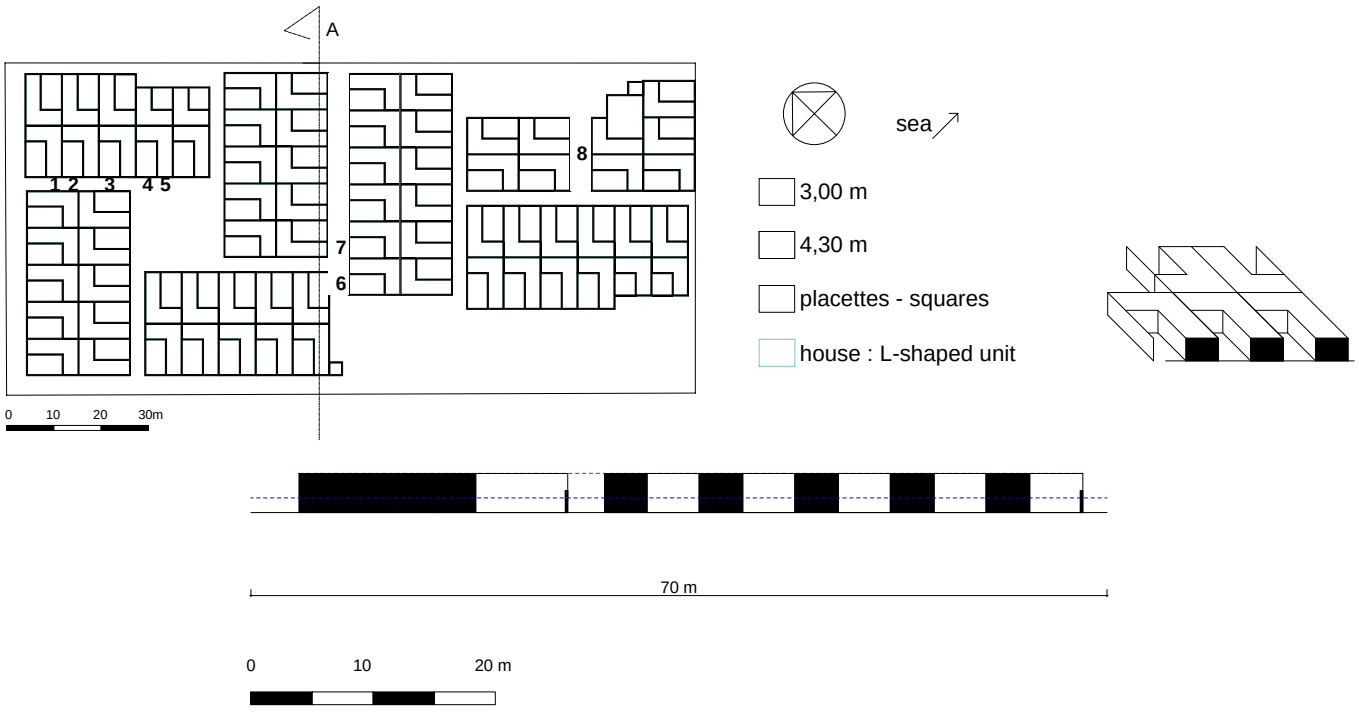


Figure 3. Ginestou. Left: Ground floor plan with pedestrian street widths and SVF locations.
Right: schematic diagram of "L" units' assembly
Bottom: Section A.
Red line: mean building height; Blue line: Absolute Rugosity or mean urban canopy height

As shown in Figure 3, Ginestou seems to be a simpler version of the Village Grec. As if it was an exercise for the more refined and developed Village Grec (built-in 1968), the plan assembles 73 "L" shaped units with one courtyard, housing the entrance door. The "L"s

have a ground floor. They are grouped by 10 or 12 in long blocks (except for two smaller blocks).

Like in Village Grec, cars are parked in the parking lots by the residents, before they head to the village on foot. Pedestrian streets are 3m wide, except for two, which is 4.3m (Figure 3). Like in the Village Grec, hedges board both sides of the streets, although they are less high here. And in the same way, the original design foresaw large green spaces in the courtyards. Courtyard walls are between 1m and 2m high, often with perforated parts to let air pass, and vary from house to house. Besides those, the village has a quite monotonous and repetitive, almost boring, character.

3.3. Case Study 3 : Gaou Bénat in Bormes-les-Mimosas, 1958

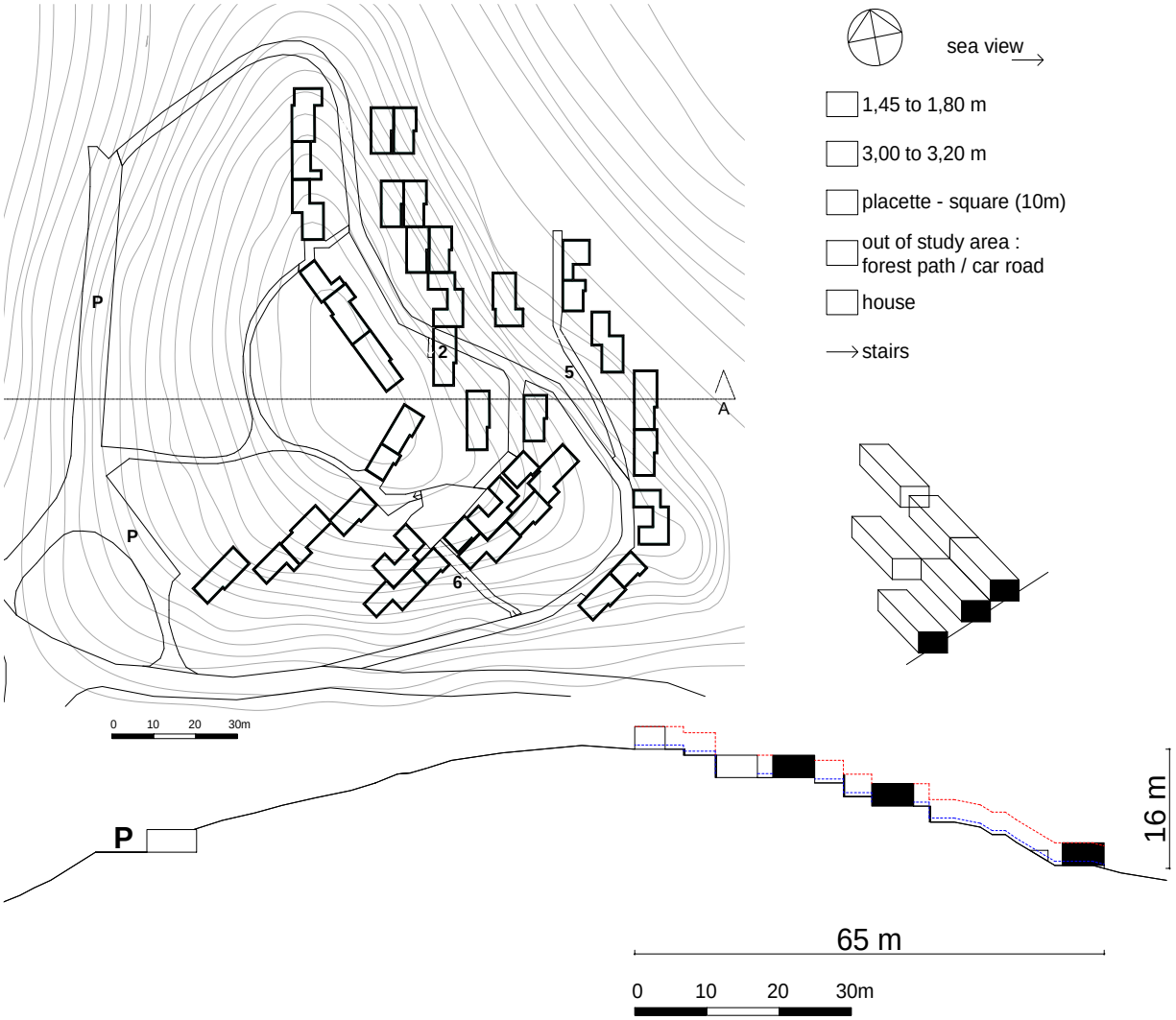


Figure 4. Gaou Bénat: Left: Ground floor plan with pedestrian street widths, slope contour lines, and SVF locations
Right : schematic diagram of the strip assembly of units on a slope
Bottom: Section A.
Red line: mean building height; Blue line: Absolute Rugosity or mean urban canopy height

The main concern for this residential area was to preserve the existing landscape, to create an "*architecture of disappearance*" as the guardian poetically put it during fieldwork (Figure 4). This was Jean Aubert's and André Lefèvre-Devaux's challenge when they were called upon for the development of the Cap Bénat. The question was how to build without

being seen, using slope and vegetation. They developed a set of regulations (called the "Cahier des charges"), with sketches and text, based on views, integration into the slope (maximum height 4.5m) and intimacy between houses. Besides, the regulations stipulate climatological aspects, like the positioning of courtyards between the house and the slope for wind and heat protection; or the troglodyte-like covering of roof terraces with earth and vegetation for coolness. The study area (sector G1 or the "Hamlet of the Minotaure") was designed and built to illustrate those regulations to promote sales. It was the first of six hamlets and the most experimental one. Later on, parcels were sold and constructed individually. Until now, every construction has to correspond to the "Cahier des Charges" and to be approved by a congregation of architects. 36 houses are carefully positioned into the slope (Figure 4). They are oriented East and South-East, towards the Eastern sea view, and only have a ground floor, often stacked at different levels and partially underground, so that views are not hidden by neighbouring units. Houses are juxtaposed, following contour lines, parallel to the slope, and forming a strip. Most of the houses are offset of the road, but enclosure walls, containing terraces and yards, border the streets.

Car parking is situated on the West along the main road that follows the contour line of the slope and that leads cars through the village. Secondary and smaller pedestrian roads or stairs radiate from here. The village centre is a "placette" or square. This results in an irregular, loose and very green tissue, attached to an irregular street network.

3.4. Case Study 4: Merlier in Ramatuelle, 1958-1965

Figure 5. Merlier. Left: ground floor: partial underground units, public pedestrian space in black
Right: first-floor plan: pedestrian street widths and SVF locations
Bottom left: schematic diagram of the grid assembly of units on a slope;
Bottom right: Section A.
Red line: mean building height; Blue line: Absolute Rugosity or mean urban canopy height

Merlier's challenge was to create holiday housing respectful of the environment that could serve as an example of other vacation developments. These were the main concerns of the private landowner, Simone Volterra. Site visit and observation led to the idea to locate Merlier and four other villages in the hills' folds and creases so that they would not be visible in

the overall landscape. Merlier was the only one built, before the developer's bankruptcy. A total of 36 houses was established in a landscape fold. The units of 12.5 x 12.5 m are embedded in the slope in a grid assembly, on different levels and distances (Figure 5).

This system allows the village to cover the natural slopes brilliantly as if it was a forest of houses. The units' backsides are partially underground. The ground floor covers only part of the square unit, and is oriented parallel to the slope, thus leaving the ground floor space to courtyards. The first floor also only covers part of the square, but is mostly oriented perpendicular to the slope, opening up to the sea view (a view for every unit!), as if the first floor were a covering "croûte", to use le Corbusier's words. As a consequence, the ground floor courtyards are partially covered (for shade). The grid positioning leaves plenty of space for "placettes" (squares) in between the units.

There is a car parking space in the North and one in the West, with access to the high part of the village in the East, and the low part of the village in the West. All other streets are pedestrian. Some streets are stairs, like the main pedestrian access from the North: scenic stairs leading down to the village, framing sea views. Streets are rather mineral, despite some green hedges and trees. The ensemble results in an irregular vernacular village-like and mineral tissue blended with an irregular street network and surrounded by trees. Openings between courtyard walls and first-floor cantilevers, between vegetation pots and terraces, between first-floor terrace walls and living room walls give an airy impression, despite the massive and partially underground units.

The design seems to have been made to foster ventilation, also in outdoor areas. Overall, there is specific attention to climatological aspects: south oriented, partially covered courtyards, wooden shutters, the presence of two water basins, vegetation pots on the façades and in the courtyards, green roofs, porous ventilation openings.

4. Results

Table 2. Case study overview (top) and results (bottom)

	Village Grec - 1968	Ginestou - 1963	Gaou Benat – 1958	Merlier 1958
CASE STUDY OVERVIEW				
Houses	53	73	36	35
Lot area (m2)	10 280	10 357	32 495	34 861
Study area (m2)	10 280	10 357	14 482	11 982
Houses / hectare	51.6	70.5	25.5	29.2
Street Orientation	NS & EW	NW/SE & NE/SW	Streets follow slope: No main direction	NS & EW
Altitude (m)	2.0	2.5	108	50
Distance from the sea (m) –	460 (East) 760 to lake (West)	730 (East) 350 to lake (West)	400 (East)	30 (South)
Dominant wind direction	NW		NNW, SE & SW	
Slope(%)	-	-	25 – E & SE	23 - S
Materials	Prefabricated concrete	Prefabricated concrete	Local schiste stone, concrete parapet wall, wood shutters, terracotta flooring	Bormes stone, Catalan vault, concrete structure and brick filling
Assembly	Small block	Long block	Strip	Grid
RESULTS				
Absolute rugosity R	1.27	1.21	0.54	1.47
Compactness Ratio C_f	0.77	0.76	0.75	0.64
Building Density (%)	33	38	17	48
Mineralization M (%)	70	73	59	70

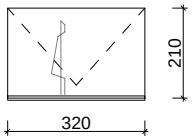
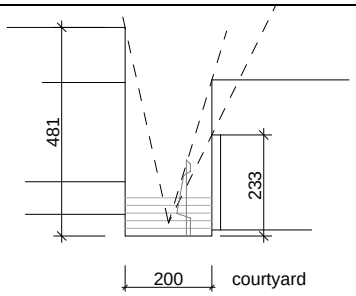
4.1 Absolute Rugosity R (Table 2)
The higher R, the more wind speed is reduced due to the morphology. Merlier has the highest R, meaning wind will be slowed down more. Gaou Benat has the lowest R, so the wind will be less impacted.

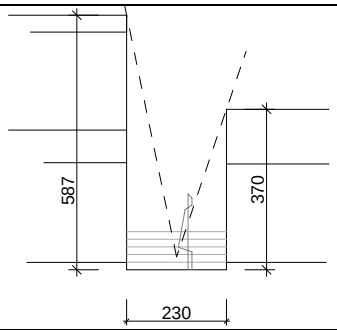
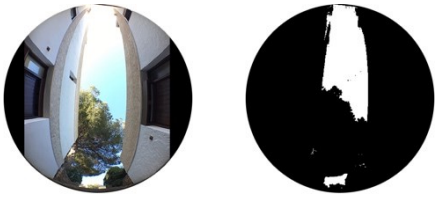
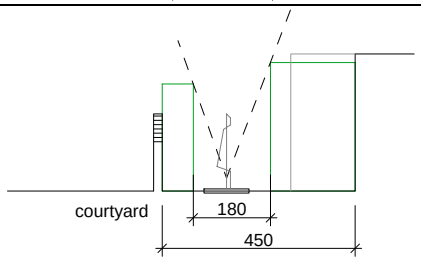
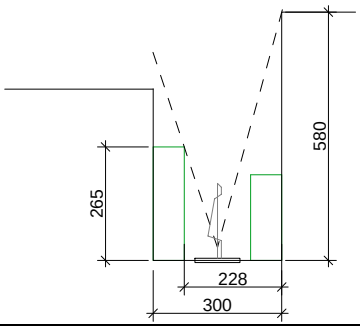
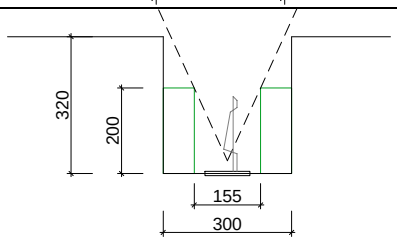
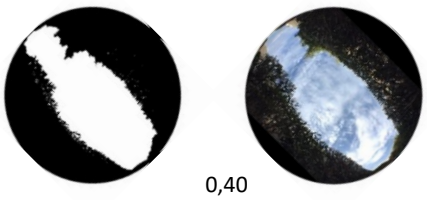
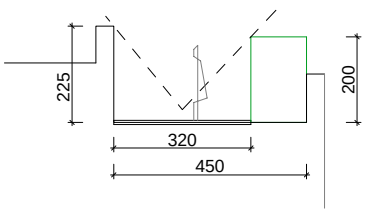
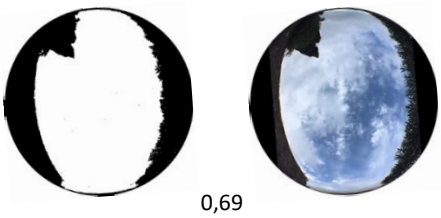
4.2 Compactness Ratio C_f (Table 2)
Merlier stands out with the lowest value (0.64), which is rather surprising since it does not look compact at all with its large cantilever overhangs. They are largely exposed to climatological elements; the grid assembly causes different street widths and thus units are only partially aligned, increasing the envelope area even more. The low value can be explained by the slope and the presence of partially underground ground floors and walls. Besides, adjacent houses have common walls on the ground floor. The first floor, on the contrary, has little common walls.
The other three case studies have similar values, for very different reasons. Ginestou has some adjacent walls and no first floor. Village Grec has more adjacent walls on the ground floor, but a very irregular layout on the first floor (with very few adjacent walls). Gaou Benat has few adjacent, but several underground walls, due to regulation proscriptions (courtyards between houses for intimacy, and between slope and houses).

4.3 Building Density - Mineralization M (Table 2)
Gaou Benat stands out for its low densities (17%) and its low mineralization (59%), compared to the case studies in Leucate. All four have different kinds of green. Gaou Benat is a natural green site, with some houses and streets carefully integrated and a low Building Density. Green is omnipresent and intermingled with the buildings. Village Grec and Ginestou are the opposite: a mineral site, with green carefully integrated. The result is small-scale green (like lace), due to a high Building Density and small units. All streets are boarded with hedges and shifted or missing units are green spaces. Ginestou has a high number of green courtyards (private green). Merlier, at last, combines both: natural green surroundings, and small-scale green within the grid (planters on all terraces and courtyards are part of the initial design).

4.4 SVF and H/W (Table 3 and Figure 6)
Although the photographic method does not cover the entire residence, it clearly shows different tendencies or characters for every residence.

Table 3. A selection of SVF, in increasing order. The fish-eye photographs are in the direction of the street (North up). The dotted line on the sections shows the visible element on the fisheye photograph, which is used for H/W. The first value of the covered passage is not considered for further interpretation.

Location and street width	Section	SVF (from low to high)	H/W
Gaou Benat 2. 3,20 m A covered passage under house		 0,01	0.66
Merlier 2. 2,00 m Stairs between two buildings		 0,10	1.94

Merlier 7. 2,30 m Stairs between two buildings		 0,15	2.08
Village Grec 7. 4,50 m Between an access courtyard and an offset unit		 0,29	1.53
Village grec 6. 3,00 m Between a unit with a terrace on the first floor – a unit with a first floor		 0,39	1.85
Ginestou 1. 3,00 m Between two units of same height		 0,40	1.29
Gaou benat 1. 4,50 m Between hedge and terrace wall - Main car and pedestrian street		 0,69	0.66

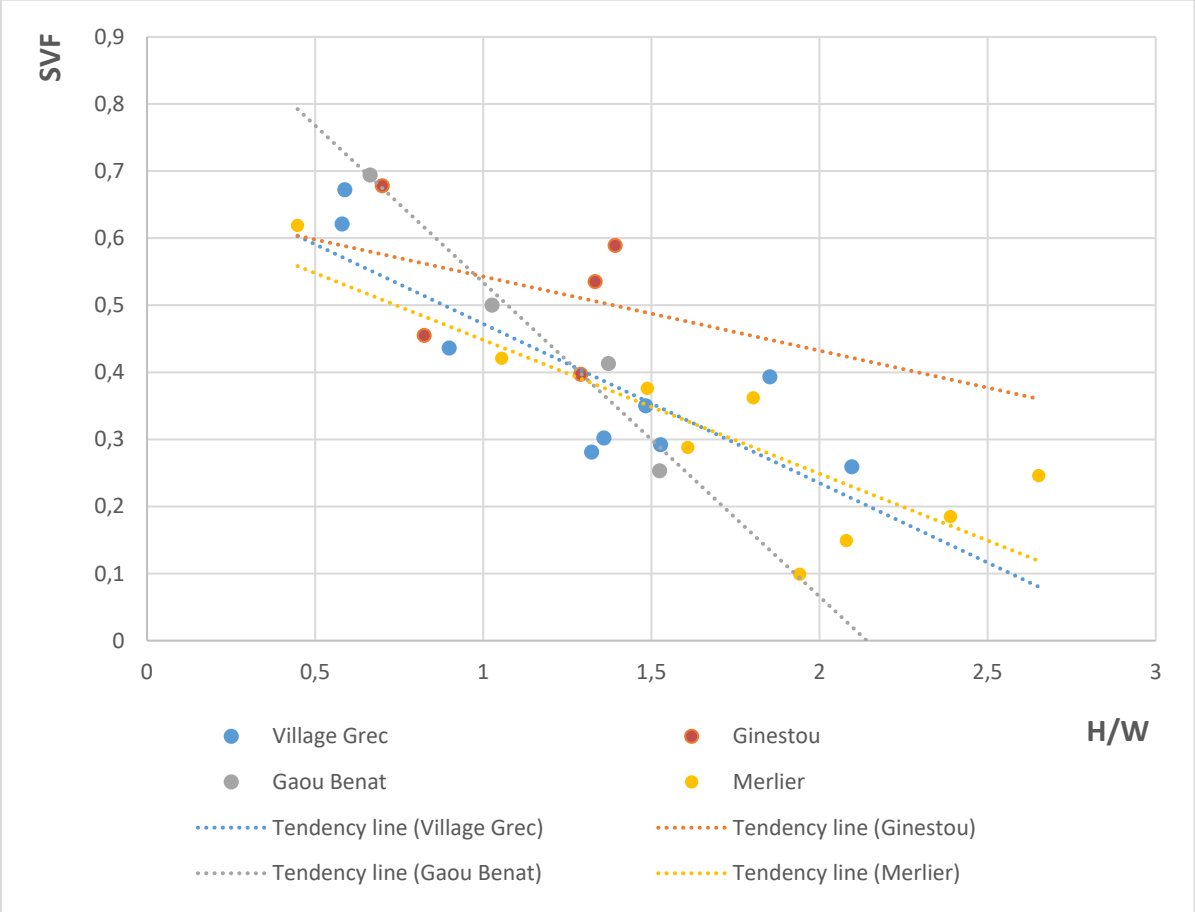


Figure 6. SVF to H/W for the four case studies with a tendency line per case study. Gaou Benat's covered passage is not considered in the graph, since it is a very small passage and has a huge impact on the tendency line.

Gaou Benat stands out because it has the lowest (0.01) and highest SVF values (0.69) (Table 3). The lowest is a punctual passage under a dwelling. There are two of those in the village. The highest SVF is on the main road for pedestrians and cars. Most dwellings keep a distance from roads to protect intimacy so that most of the roads are boarded by yard walls or courtyard walls, which are lower than building façades. Also, the roads are parallel to the slope, so there's always a house higher, and another one lower than the road. This all adds up to a high SVF. The small SVF of Gaou Benat is on punctual spots, like two covered passages, a stair leading to the central square, or part of a secondary road. The main road and central square have a high SVF.

Merlier stands out with the lowest SVF after Gaou Benat's passage (0.1 and 0.15) (Table 3) and the highest H/W (2.65 and 2.39) (Figure 6), due to the presence of a second floor (and third floor for some units), and to vegetation (public and private), both are on the stairs. The grid morphology has several more stairs with similar H/W. Thus, several areas in the residence are well protected against summer heat.

Village Grec does not stand out but has a similar tendency line as the Merlier (Figure 6). Offset first floors do not influence SVF, high hedges and trees do. This is because it does not have passages with a very low SVF, although finding "the smallest passage of the residence" was part of the fieldwork. The lowest SVF is 0.4 (Table 3). All passages have a minimum width of 3m, there's no first floor and hedges are lower than in the Village Grec. Courtyard walls are between 1m and 2m, which is lower than a unit wall. Besides, Candilis' search for intimacy and non-monotony led to pedestrian streets where courtyards and buildings take turns, meaning there are a few passages with high H/W Ratio. Ginestou has the highest SVF values, the lowest H/W Ratios (Table 3) and the highest tendency line (Figure 6).

All low SVF measures are low thanks to vegetation (except for Gaou Benat's covered passage). Building height is not decisive: a section with a higher building and a high H/W

of 1.85 (Village Grec number 6 – Table 3) can have a higher SVF (0.39) than a section with a low courtyard wall and H/W 1.53 (Village Grec number 7 – Table 3): SVF 0.29, because of the hedges. Trees also have a large impact on SVF. The vegetation might be part of the residence's public areas or part of the private courtyards. The smallest SVF of the Merlier (0,10) illustrates the latter with private vegetation from the neighbouring courtyard covering the passage.

4.5. Comparaison (Figure 7)

It is not possible to point out one residence and label it the "best environmental performance" in hot summer conditions since the link between morphology and microclimate is too complex. It is possible though to compare their parameters and to indicate the residences that are more likeable to have a positive effect in hot summer conditions concerning these parameters (the lower the values, the better, except for the H/W Ratio).

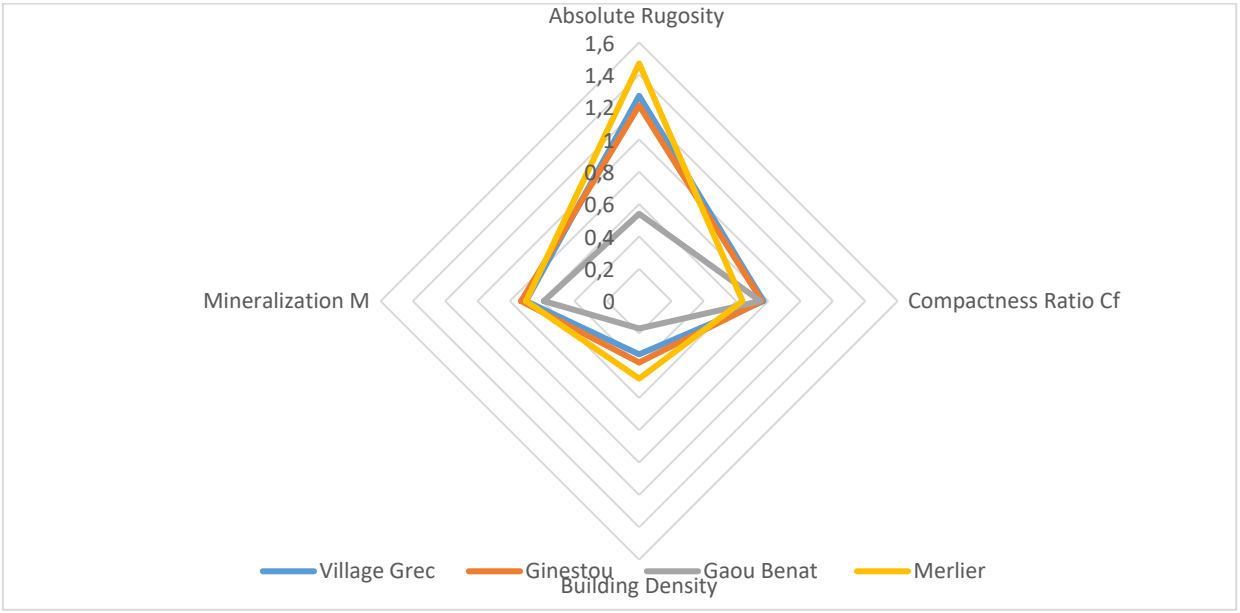


Figure 7. Case study comparison. The residences with the most positive effect in hot summer conditions are the ones with the lower values. Gaou Benat stands out because the wind has fewer obstructions (low Absolute Rugosity) and it's greener (low mineralization). Merlier stands out because it has the lowest Compactness Ratio.

Gaou Benat stands out because the wind has fewer obstructions and it's greener (low mineralization). Merlier stands out because it has the lowest Compactness Ratio, the lowest SVF and the highest H/W Ratio.

5. Discussions and conclusions

The obtained Absolute Rugosity R values (0.54 to 1.47), are lower than the reference value of the historical city centre of Toulouse: 7.1 (Adolphe, 2001). This makes sense since historical centres have several floors. They can be compared though to the reference value of 0.8 for a suburban area of Toulouse, with a majority of individual houses (Adolphe, 2001).

This value alone is not very representative of the subtle design strategies that have been implemented in the residences to favour air movement: brick-on-the-side-walls and courtyard walls with openings for air movement, balconies with offset walls to let air pass… Further study will add other values, like porosity, roughness length, street orientation and main wind directions.

The obtained Compactness Ratio C_f values (0.64 to 0.77) are higher than reference values of 0.584 for a traditional courtyard morphology (like central Marrakech with 9m high houses) (Ratti et al., 2003). They are also higher than 0.404 for more modern urban morphologies (3 floors, 9m high, pedestrian streets without cars). If we would imagine an individual house with the same volume as a Merlier unit, with two floors and a rectangular floor plan of 8 x 10m, the compacity ratio would be 0.61. Again, the obtained values are higher. For the same volume as the Ginestou, with a single

rectangular floor of 6 x 9m, the compacity ratio would be 0.87. This individual house with one floor would be less compact than the additive grouped housing. So, the additive case studies are not compact at all.

High Compactness Ratios mean a large envelope surface in direct contact with environmental conditions. Low compacity means less heat loss in wintertime and less heat gain in the summertime. So, in general, low compacity is favoured. This was also the hypothesis used for this study. But is low compacity always better? Ratti et al. (2003) claim that higher compacity, in warm climates, can also mean a higher wall mass, that can function as a heat sink. This means that, when combined with inert walls and high diurnal temperature swings (large temperature difference between day and night), high compacity can have a positive effect, according to this research. Further research will point out whether there are other conditions where a high Compactness Ratio has positive effects.

The obtained H/W values are higher than Oke's reference values for a mid-latitude city with 45° latitude, like for example Avignon or Lyon (Oke, 1988). Leucate is at 42,85°. He mentions theoretical values 0.4 as a lower limit, to allow solar access and 0.60 - 0.65 as a high limit for wind protection and shade. The measured case study values go from 0.66 – 2.08, which is higher. This means the additive residences are more adapted to hot summer conditions than theoretical mid-latitude morphologies.

The measured SVF values (0.10 to 0.69) are higher than Ratti's reference values of 0.13 for a traditional courtyard morphology (like central Marrakech with houses of 9m high) (Ratti et al., 2003), except for one measure in Merlier. They're also higher than more modern urban morphologies (3 floors, 9m high, pedestrian streets without cars): 0.23, except for three measures in the Merlier. This means that the street proportions of these additive residences are more open to the sky than the traditional vernacular morphology of Marrakech. This Moroccan city centre is known for its narrow streets, which are well shaded during the day, and cool slowly at night when temperatures drop. When we make abstraction of vegetation, the additive residences' streets are thus less adapted to hot summer conditions than Marrakech. We should keep in mind, though, that the architects' reference was vernacular villages and not vernacular urban city centres.

Compared to Adolphe's reference values of 95% Mineralization (Adolphe, 2001) for Toulouse's medieval city centre, the measured values are 22-36% less mineralized, or the additive morphologies are greener than historical city centres. The interpretation of results depends on the reference values. This study compared obtained values to reference values of urban canyons, that have a symmetrical section for a certain length. Many previous studies narrowly focus on (often vernacular) urban centres. Consequently, the current study compared the results to available reference values of urban centers that have a certain thermal functioning in high temperatures. Further research will need to be undertaken to explore whether there are other thermal ways of functioning, for example for village centres or green palmeraies with sparse housing. This research focused on an environmental assessment of additive holiday housing from the "Glorious Thirty" in France, with an integrative approach. Four neighbourhoods were analyzed and compared to each other, as well as to the results of the literature review. Although the residences have been studied before, from a historic and architectural point of view, their environmental functioning in the summertime has not yet been evaluated. This research, therefore, contributes to the search for semi-collective alternatives of individual housing in peri-urban areas.

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Conflict of interests
The authors declare no conflict of interest.

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Urbanization, Housing Quality and Health: Towards a Redirection for Housing Provision in Nigeria

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ABSTRACT

Nigeria's housing provision is perceived in terms of quantity with less attention to its quality and impact on people's health. The quality of indoor air in housing and its associated risks to human health was assessed in this paper to improve housing provision in Nigeria. Quantitative data collected from Bauchi, Nigeria includes household surveys, housing characteristics, indoor carbon dioxide (CO2), and particulate matter (PM2.5 and PM10). PM2.5 and PM10 recorded in the building were (63 µm/m3) and (228 µm/m3) and observed to be greater than safe values of 25 µm/m3 (PM2.5) and 50 µm/m3 (PM10) recommended by the World Health Organization (WHO). Some building features associated with some ailments were found to be risk factors. The study recommended a redirection for more quality housing provision. It concludes that housing characteristics should be targeted for public health interventions as a means of improving the quality of urban housing in Nigeria.

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1. Introduction

Housing has become an important issue in meeting the challenges presented by global urbanization. In developing nations, particularly in Africa, the need for housing has repeatedly emerged and become so critical. This is most pronounced with Africa's population projected to reach over 700 million by 2030. African nations have over 4.5 percent yearly urbanization rate, which has resulted in a population explosion, resource constraint and shortage of houses. Consequently, in numerous

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African nations, access to safe, decent and affordable housing remains a challenge(Wong, 2014). Currently, 72% of the urban population in Africa resides in slums with risks of diseases and insecurity. To meet the challenges of housing demand arising from rapid urbanization, housing delivery should not be limited to quantity at the expense of quality in the provision of a healthy, safe, inexpensive, and satisfactory shelter.

Population growth in most metropolitan urban communities in Nigeria has assumed a geometrical progression with such an impact on housing provision which its demand has become disproportionate in level. This extent of the housing shortage has become extensive with the deficit considered quantitatively and qualitatively. In 2019, the urban population rose to 51.2 percent, meanwhile over the last 50 years, it grew substantially from 17.8 to 51.2 percent and rose to a maximum of 3.19 percent in 1981 and then decreased to 1.61 percent in 2019. According to Aliyu and Amadu (2017), in the year 2011, the Nigeria housing deficit was estimated to be within the range of 12 and 16 million. This comes with the challenge of providing adequate housing for close to 200 million people. Consequently, most people live in substandard housing with the problem exacerbated by continuous urbanization making housing provision more demanding especially for the low-income groups.

Among the Wong's (2014) key strategies are to advance sustainability in the aspect of the development of human settlement through the provision of adequate housing for everyone. The implication of this agenda is the entitlement of everyone to reside in a quality house that assures a healthy, safe, secured, happy, and comfortable life. According to Cattaneo, Galiani, Gertler, Martinez, and Titiunik (2009), there is a correlation between housing quality and the health, satisfaction and happiness of the occupants. Thus, among the prominent criteria in quality housing provision should be occupant's health and well-being. In this context, Ranson (2002) asserted that healthy housing should not be viewed as staying away from sicknesses but rather to incorporate sufficient spaces to meet the occupants' need for daily comfort. In light of these, attention should be given to ensure that housing delivery encompasses quality and health provision for the occupants.

2. Literature Review and Conceptual Framework

Several researchers (Arundel, et al., 1986; Guenther & Vittori, 2008; Li et al., 2007) have posited that adequate ventilation should be central in designing buildings to lessen the possibility of transmitting infectious diseases. Similarly, other researchers (Ulrich et al., 2008) have also underscored that buildings should be designed to lessen occupants' exposure to risks of diseases. Such risks, according to the Institute of Medicine (2011) include sick building syndrome and other risks that could arise from the occupants becoming exposed to pollutants found indoors. Despite the growing body of knowledge linking architecture and human health, residential housing is still associated with significant health hazards. The Office of the Surgeon (2009) and Jacobs (2011) defined healthy housing as built and maintained apartments and their immediate environment enhancing the health of its occupants. Hornberg and Pauli (2011) extended the definition as houses that provide sufficient physical, natural, and states of mind that strengthen wellbeing, solace, and security. While some authors (Udofia, Yawson, Aduful, & Bwambale, 2014) argues that among the factors leading to poor health conditions of building occupants are poor environmental and housing conditions which could trigger the transmission of infectious diseases, others (Alnsour, 2011; Rauh Virginia, Chew Ginger, & Garfinkel Robin, 2002), posit that the materials from which the building is built may also influence the occupant's wellbeing. Rauh Virginia et al. (2002) further expressed that other ways through which occupant's health is influenced by housing are when exposed to poor conditions and other deficiency in the provision of basic facilities to make housing liveable. Fullilove and Fullilove (2000) validated this view by asserting that housing delivery deficiency could worsen housing conditions which in turn could trigger a range of diseases, disorders and dysfunction. As such, housing quality as described by Muhammad, Kasim, Martin, Mohammed, and Adamu (2015) should not be limited to physical building conditions and basic facilities for liveability, but also include indoor air quality. Thus, housing also requires quality and not just quantity. This view is upheld by Aderamo and Ayobolu (2010) who suggested that the adequacy of housing must be both qualitative and quantitative to accomplish its ultimate goals. Coker, Awokola,

Olomolaiye, and Booth (2008) and Jiboye (2010) additionally corroborated that housing quality is a vital component that influences occupant's health and well-being. This view agrees with those of Kembel et al. (2012) who described buildings as complex ecosystems containing microorganisms in trillions that connect along with living creatures and their environment. According to Aribigbola (2011) and Amao (2012), housing quality should, therefore, enhance good living, possess minimum health standard and should be affordable for all.

Several studies (Björnsson et al., 1995; Emmelin & Wall, 2007; Ishihama et al., 2009; Kovesi et al., 2007) have reported that poor indoor air quality poses an infection risk through the concentration of airborne bacteria which are associated with adverse respiratory symptoms. According to the World Health Organization (WHO), the quality of indoor air is projected to become the eighth major factor that will account for the two percent in the spread of diseases worldwide (WHO, 2006). Graudenz et al. (2005) further reported that indoor variables such as temperature, humidity, ventilation and accumulated biological pollutants can deteriorate the quality of the indoor environments. As such, Aderamo and Ayobolu (2010) observed that other determinants of housing quality included internal facilities, walling materials, and the source of lighting in the absence of electricity.

Studies in Nigeria have also been undertaken on the factors affecting housing. For instance, in Ibadan, Amao (2012) established that several houses were in a poor condition, lacked adequate ventilation, lighting, and a pleasant external environment. These findings relate to a study in Ibadan by Coker et al. (2008) which showed that the houses were grossly deficient for habitation. Similarly, in Osun State, Lanrewaju (2012) also established the existence of poor-quality housing that was below the required standard. Despite numerous studies focusing on the varied impacts of health linked to poor housing quality, there is still a scarcity in the literature on the impact of urbanization on healthy housing delivery in the developing countries with a particular reference to Nigeria, a gap filled in the current study. Arising from the foregoing, this study sought to assess the indoor air quality as a health risk in the existing urban housing in Nigeria using Yelwa ward of the Bauchi city as a case study. The specific objectives were (i) to determine the house(s) more susceptible to ill-health based on their indoor CO_2 and PM_{10}/$PM_{2.5}$ and (ii) to find any association among the health symptoms linked to the building parameter/air quality. This paper, therefore, fills the current gap in knowledge in the provision of healthy housing development in Nigeria.

A conceptual framework (Figure 1) was developed to investigate the factors identified in the literature review. It summarises and describes the relationship, connection and association between factors that combine to influence the implications of urbanization on housing and health in Nigeria. The major factors identified are classified to include housing drivers, housing deficit, housing delivery, current housing delivery deficiency and housing dweller's demand (the expectations of the occupant).

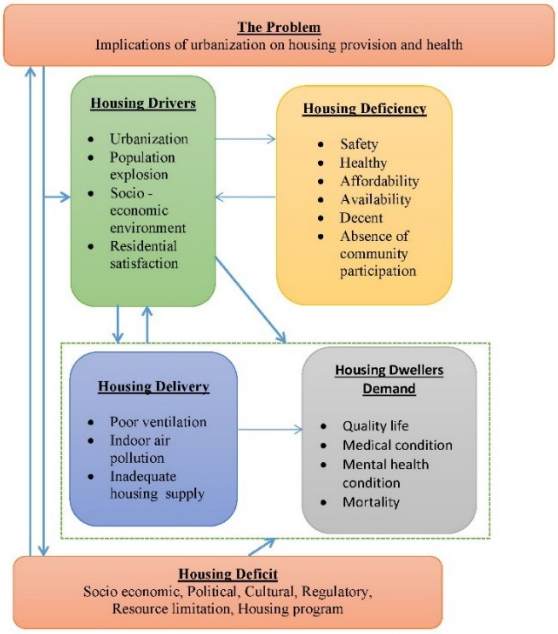

Figure 1. Conceptual framework to assess implications of urbanization on housing and health (Developed by Author)

3. Methods

3.1 Location of Study

Nigeria, a country in West Africa is divided into 36 states and a Federal Capital Territory (FCT). Bauchi is a city in the North-East geopolitical zone of Nigeria and according to the 2006 population census by the National Bureau of Statistics (2015) has a population of 493,810. Officially, Bauchi city is divided into eight wards, each comprising of 43,654 households, spread across various housing densities (i.e. low, medium, and high) in residential areas (Bello, Danjuma, & Adamu, 2007; Gani, Chiroma, & Gana, 2012).

3.2 Study Population

The study area is divided into eight wards having over 421, 187 residents, which formed the sample frame. Yelwa ward having the highest number of population (50,533) and highest number of households (6563) living in naturally ventilated low-rise housing types was purposively selected as a case study. This formed the target population. Since there are 6563 households in the study area, a sample size of 150 households was obtained from the calculations (Creative Research Systems, 2003; Czaja & Blair, 2005) below:

$$SS = \frac{Z^2 * (p) * (1-p)}{C^2}$$

Where:
Z= Z value (e.g. 1.96 for 95% confidence level)
P= percentage picking a choice expressed as decimal (.5 used for sample size needed)
C= confidence interval, expressed as decimal

The sample size was calculated as follows:

$$SS = \frac{1.96^2 * (0.5) * (1-0.5)}{0.1^2}$$

SS= 96.04

From the above calculations, the number of households needed is ninety-six. However, the figure obtained requires further some adjustments for finite populations. Thus, using the formula adopted from Czaja and Blair (2005) the finite populations was calculated as:

$$New\ SS = \frac{SS}{1 + \frac{SS-1}{POP}}$$

Where:
POP= population

$$New\ SS = \frac{96.04}{1 + \frac{96.04-1}{6563}}$$

$$New\ SS = 94.67$$

Thus, from the figure obtained above, a sample size ranging from 95 and above was required. To make provision for non-response, 150 households were selected and invited to participate in the survey using stratified random sampling. The survey involved a household questionnaire comprising of 30 questions and a building audit checklist. A member of each household was required to answer the occupant survey questions. Only 116 consented to participate in phase one of the

study through the use of questionnaires. The participants who were 18 years and above were asked if anyone living in their houses had experienced a particular health issue and/or experienced any symptoms itemised in the survey questionnaire at any point in the past five years. The main outcome of interest was self-reported illness. This was defined as at least one of the diseases and its symptoms (cough, sore throat, or runny nose). Ethics approval was obtained from the University of Leeds, the United Kingdom and every participant signed a form indicating their consent and voluntary agreement to participate anonymously and with their confidentiality protected.

3.3 Source of Data

Data collection was undertaken in three phases. The first phase involved the administration of a questionnaire on occupant's background and health complaints through direct contact with the building occupants by the research assistants. Phase two involved building audits and phase three involved indoor air quality monitoring. Air quality parameters were measured using Airnode sensors (Airvisual, USA) whose CO_2 values were calibrated against a Rotronic CL11 (Rotronic, BSRIA, Bracknell, UK). Occupant's exposure to indoor CO_2 emission, $PM_{2.5}$ and PM_{10} particulate matter were recorded above 1m from the ground in the bedroom and the living room for a minimum of 12 hrs with Airnode sensors in the dry season (i.e. October–November 2017).

3.4 Statistical Methods

In the current study, the incidence of the occupant's health complaints constituted the dependent variable as the major outcome. Recoding was done to indicate 0 as no symptoms and 1 as having symptoms. Respiratory symptoms were classified into two, namely; upper and lower symptoms. The independent variable constitutes occupant's demographic characteristics, building operation and indoor environment conditions (i.e. temperature, relative humidity, and presence of CO_2). Data analysis employed IBM SPSS Statistics 23 for simple descriptive statistics to generate the results. To identify the risk factors of buildings on the occupants, logistic regression models were employed along with bivariate logistic analysis. Other non-parametric tests such as Odds ratios, Chi-squares and Fisher exact tests were carried out to assess the relationships between the dependent and independent variables. The significant variables for the bivariate investigation having the value of 'p' under 0.05 were added in the logistic regression. Ranking of indicators of ventilation (CO_2) was carried out according to the WHO guideline value using the following values as the benchmark; less than 600 ppm (acceptable); between 600–1300 ppm (complains); and 1300 ppm (very bad).

4. Results and Discussions

Findings show that 67% of the respondents were male, while 33% were female. The typical family in the survey consists of a family of four members and earned below N20, 000 ($50) monthly (i.e. about $1.25 per day). Particulate matter was quantitatively assessed on the participating households. The mean particulate matter found was 63 µm/m³ and 228 µm/m3 respectively, ranging from 10 µm/m³ - 231 µm/m³ (PM2.5) and 20 µm/m³ - 1667 µm/m³ (PM10). Findings demonstrate that the majority (79.5%) of the household's exposure to the PM2.5 value recorded surpassed the value considered to be safe for human health (i.e. 25 µm/m3 for PM2.5 and 50 µm/m3 for PM10) prescribed by WHO. This suggests that the exposure of the greater number of the respondents (79.5%) was more than twice greater in $PM_{2.5}$ and multiple times more in PM_{10} than the recommended value. These findings are in line with the results from previous studies conducted in India where Ansari et al. (2010) and Saksena, Prasad, Pal, and Joshi (1992) also reported the high mean particulate matter.

With evidence from the reviewed literature on the outcome of excessive concentrations of $PM_{2.5}$ (i.e. breathing difficulties, irritation of the lungs, risks malfunctioning lungs, etc.) in the indoor environment, this could account for its impact on the occupant's health conditions. Similarly, the occupants having contact with a greater value of PM_{10} in the indoor environment proved that they are at risk of respiratory illness (Dockery & Pope, 1994). Households with these respiratory illnesses are responsible for a greater percentage of human loss of life resulting from indoor air pollution. The high concentrations of the PMs in the indoor environment could be a result of (i) some of the

houses are surrounded by untarred roads and unpaved walkways which allows the entry of a large number of dust particles into the buildings (ii) the absence of landscaping elements such as green areas and trees around the buildings to absorb the dust particles and filter the air (iii) improper building orientation to determine the appropriate placement of fenestrations (i.e. windows) and occupant's behavioural pattern in the operation of the buildings.

Other diseases associated with the respiratory system include tuberculosis (TB), asthma, pneumonia and influenza. In this study, the incidence of influenza was found to be significantly related to $PM_{2.5}$ (Wald = 5.087 p = 0.024). On the other hand, PM_{10} has Wald statistics with significant p-values for two ailments; chickenpox (Wald = 4.029, p = .045) and influenza (Wald = 4.002, p = .045). Meanwhile, a greater percentage (41.4%) of the respondents answered in the affirmative that their indoor environment affected their health while 30.2% disagreed. However, 19.8% claimed that they did not know if the indoor environment affected their health while the remaining 8.6% gave no response. Findings obtained from Table 1 indicated that the symptom that was generally acknowledged by most of the respondents is weakness/fatigue. This was indicated by the largest percentage (78.4%) of the respondents and was closely followed by dizziness (69.8%) and headaches and stiff neck (68.1%). The least popular symptom acknowledged was "coughing up blood or sputum (mucus from deep inside the lungs)" which was identified by 14.1% of the respondents.

Table 1. Symptoms of illness experienced by the respondents in the indoor environment.

SN	Variables	Yes		No	
		f	%	f	%
1	Headaches and a stiff neck	79	68.1	37	31.9
2	Dizziness	81	69.8	35	30.2
3	A tingling/pins/needles feeling	33	28.4	83	71.6
4	Difficulty or fast breathing	42	36.2	74	63.8
5	Increased heart rate	37	31.9	79	68.1
6	Loss of consciousness (i.e. fainting)	27	23.3	89	76.7
7	Weakness/fatigue	91	78.4	25	21.6
8	Sore throat	63	54.3	53	45.7
9	Muscle pains	62	53.4	54	46.6
10	Severe watery/or loose diarrhea	42	36.2	74	63.8
11	Nausea (i.e. the feeling that you are going to vomit	39	33.6	77	66.4
12	Vomiting everything	22	19.0	94	81.0
13	A bad (severe) cough that lasts 3 weeks or longer	37	31.9	79	68.1
14	Pain in the chest	53	45.7	63	54.3
15	Coughing up blood or sputum (mucus from deep inside the lungs)	17	14.7	99	85.3
16	Sore or itchy eyes	62	53.4	54	46.6
17	Skin complaints/rashes/eczema	59	50.9	57	49.1

To determine the susceptibility of the houses to ill-health based on their indoor CO_2 and $PM_{10}/PM_{2.5.}$, the overall mean concentration of CO_2 obtained was 584 ppm. This was less than 600 ppm, which indicates on the range (for acceptable value) that the ventilation was adequate. Although some of the houses exhibited adequate ventilation, the reason for this could be a result of multiple interacting factors such as the way the occupants operated their buildings, many houses were built within fence walls and around a courtyard (Figure 2), hence, households were able to leave their windows opened for long hours both night and day.

Figure 2. Houses were built within fence walls and around the courtyard allowing windows to be opened.

However, findings show that several houses due to their poor design approach (Figure 3) had their CO_2 up 2201ppm (i.e. more than 1300 ppm (very bad). Although the p-values of the Wald statistics show that CO_2 is not a significant risk factor in the incidence of any of the diseases in the prevailing residents' indoor environment (RIE), the indices as none of the Wald statistics for CO_2 is less than 0.05. The average indoor temperature obtained in the

houses was 28.9 °C and the mean relative humidity was 40.7%. These values exceeded by slight the difference compared to the values suggested by ASHRAE, which is between 21 – 26 degrees Celsius (temperature) and 30 - 70 percent (relative humidity) (ASHRAE, 1992). The slightly higher than the recommended value of the indoor temperature could be a result of inadequate window openings and in the appropriate window placement on the buildings for sufficient ventilation. This indicated that most of the occupants are not thermally comfortable coupled with the challenge that the majority of the occupants earned below $50/month and as such unable to afford to pay for the energy required to make their houses comfortable.

Figure 3. Windows of houses opening into a narrow lobby with insufficient setbacks between buildings, causing insufficient airflow for adequate ventilation.

Logistic regression analyses of the incidence of diseases were carried out on the RIE indices across the houses under study (Table 2). A cursory look at the p-values of the Wald statistics for the houses concerning each of the diseases shows that it is only in the incidence of meningitis that houses become a significant risk factor, as the p-value is less than 0.05. In all other cases, the p-values surpassed 0.05 and hence houses are not significant risk factors for the diseases. For Meningitis, however, the odds-ratio (Exp. B) is slightly greater than one.

Table 2. Susceptibility to ill-health based on indoor CO_2 and $PM_{10}/PM_{2.5}$.

	Variables in the Equation							Model Summary		
Disease	Variable	B	SE	Wald	Df	Sig	Exp(B)	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
Tuberculosis	House	-.076	.112	.452	1	.501	.927	34.510	0.018	0.043
	PM2.5_24Hrmean	.004	.014	.097	1	.755	1.004			
	PM10_24HrMean	.001	.003	.110	1	.740	1.001			
	CO2_24HrMean	-.001	.003	.139	1	.709	.999			
	Constant	-1.891	2.132	.786	1	.375	.151			
Pneumonia	House	-.091	.066	1.918	1	.166	.913	78.528	0.054	0.079
	PM2.5_24Hrmean	-.007	.011	.363	1	.547	.993			
	PM10_24HrMean	.001	.002	.291	1	.589	1.001			
	CO2_24HrMean	.002	.001	1.498	1	.221	1.002			
	Constant	-1.250	1.072	1.359	1	.244	.286			
Asthma	House	.021	.095	.050	1	.823	1.021	44.512	0.014	0.030
	PM2.5_24Hrmean	-.005	.018	.082	1	.775	.995			
	PM10_24HrMean	.000	.004	.011	1	.916	1.000			
	CO2_24HrMean	.001	.002	.568	1	.451	1.001			
	Constant	-2.825	1.549	3.325	1	.068	.059			
Meningitis	House	.149	.075	3.927	1	.048	1.161	69.308	0.069	0.105
	PM2.5_24Hrmean	.006	.010	.379	1	.538	1.006			
	PM10_24HrMean	-.002	.003	.670	1	.413	.998			
	CO2_24HrMean	.000	.002	.008	1	.928	1.000			
	Constant	-2.412	1.324	3.318	1	.069	.090			
Measles	House	.016	.068	.057	1	.812	1.016	76.735	0.046	0.066
	PM2.5_24Hrmean	.012	.011	1.167	1	.280	1.012			
	PM10_24HrMean	-.004	.003	1.819	1	.177	.996			
	CO2_24HrMean	.001	.001	.969	1	.325	1.001			
	Constant	-1.990	1.132	3.092	1	.079	.137			
Chickenpox	House	.104	.065	2.545	1	.111	1.110	82.412	0.129	0.179
	PM2.5_24Hrmean	-.012	.010	1.366	1	.242	.988			
	PM10_24HrMean	.004	.002	3.373	1	.066	1.004			
	CO2_24HrMean	.001	.001	.600	1	.439	1.001			
	Constant	-2.467	1.160	4.522	1	.033	.085			
Influenza	House	.121	.064	3.557	1	.059	1.129	92.728	0.149	0.206
	PM2.5_24Hrmean	-.027	.011	6.597	1	.010	.973			
	PM10_24HrMean	.005	.003	3.414	1	.065	1.005			

	CO2_24HrMean	-.002	.002	2.057	1	.152	.998			
	Constant	.028	.155	.034	1	.854	1.029			
Malaria	House	-.020	.017	1.421	1	.233	.980			
	PM2.5_24Hrmean	.004	.005	.530	1	.467	1.004			
	PM10_24HrMean	.000	.003	.009	1	.923	1.000	25.797	0.013	0.055
	CO2_24HrMean	4.349	2.474	3.089	1	.079	77.41			
	Constant	.028	.155	.034	1	.854	1.029			

To determine the correlation between the total number of symptoms and illnesses observed by households and building parameters, a Spearman's rank-order correlation was performed (Table 3). There were weak positive correlations between the total number of symptoms and four building parameters (main building orientation, type of housing unit, the orientation of window opening, and size of household). The only significant relationship was observed between the total number of symptoms and the type of housing unit (r = .215, p = .021). All the other relationships were not statistically significant. There were weak negative relations between the total number of symptoms and four of the remaining building parameters (the type of window, window size, type of cooking fuel and main source of lighting). The only significant relationship was observed between the total number of symptoms and the main source of lighting (r = .300, p = .001). All the other relationships were not statistically significant (Table 3).

Table 3. Correlation between the number of symptoms and building parameter/air quality.

Correlations			
			Total number of symptoms experienced
Spearman Rho	The main building orientation	Correlation Coefficient	.097
		Sig. (2-tailed)	.303
		N	115
	Type of housing unit	Correlation Coefficient	.215
		Sig. (2-tailed)	.021
		N	115
	Window size	Correlation Coefficient	-.065
		Sig. (2-tailed)	.508
		N	107
	Household size	Correlation Coefficient	.105
		Sig. (2-tailed)	.263
		N	115
	Type of window in the bedroom	Correlation Coefficient	-.128
		Sig. (2-tailed)	.173
		N	114
	Size of the bedroom window	Correlation Coefficient	-.081
		Sig. (2-tailed)	.393
		N	114
	Window orientation in the bedroom	Correlation Coefficient	-.171
		Sig. (2-tailed)	.066
		N	116

The building characteristics were cross-tabulated with the incidence of the reported diseases to explore the association between them; Chi-square values and Fishers' exact test were computed at 0.05 level of significance. The results show that the main building orientation is significantly associated with the incidence of measles (p<0.02), meningitis (p< 0.03) and TB (p< 0.04). The materials used for floor covering were also found to significantly associate with Meningitis (p<0.01), measles (p<0.02) and influenza (p<0.002). Their odds ratio is less than 1 implying that as the floor material improves from earth, wood, cement and to rug, the odds of incidence of the three ailments are reduced. This result agrees with the explanations on the findings of Alnsour (2011) that the health of building occupants is directly linked to the quality of the building materials used for the building. Meanwhile, logistic regression analyses of the diseases along with indoor air quality show no relationship with CO_2. However, PM10 shows a significant relationship with chickenpox (Wald = 4.029, p = .045) and

influenza (Wald = 4.002, p = .045); while PM2.5 (Wald = 6.263, p = 0.012) is a significantly related to Influenza. The above findings point to the general trend observed towards the approach to indoor environments that exists in current housing provision in the study area. The findings revealed the required intervention and measures for the consideration of housing indoor environments.

5. Conclusion and Recommendations

This paper presented the implications of urbanization on housing provision and its consequences on the building occupant's health. It established that as urbanisation increases, there is a corresponding increase in huge housing deficits for the teeming Nigerian populace. Exacerbating the already huge challenge of housing deficits is the less attention given to housing quality as a significant area of the non-clinical contributor to the quality of health of building occupants. This study found some association between certain building characteristics and some diseases experienced by the building occupants as potential risk factors in the residential housing provision. The outcome of this study calls for a redirection in quality housing provision in Nigeria. This should be occupant-centered with reduction strategies of indoor particulate matter which combine to deteriorate the indoor environments that trigger susceptibility to infectious diseases. Future intervention in public health policies for quality housing provision is needed to contribute towards efforts to address the conundrum of a safe and healthy-promoting building for the growing urban poor populace in Nigeria. To curtail the implications of urbanization on housing provision in Nigeria, this paper recommends the need for synergy between the built environment professionals and the national government to formulate policies and develop guidelines that promote healthy housing. This could limit an array of avoidable diseases arising from deficiencies in housing quality. Besides, there is a need for constant revision of the nation's current housing policies to reflect the importance and improvement required for healthy housing. This would serve as the basis for providing healthy and socially acceptable housing for the teeming populace in Nigeria. In practice, building design professionals need to incorporate comprehensive aspects of healthy housing into their design such as (i) appropriate building orientation to capture natural daylighting and adequate natural air for appropriate airflow and air flush within the buildings (ii) appropriate positioning of fenestrations on the elevations of the buildings (iii) introduction of shading elements around the windows and entrances to reduce overheating of the interior, and (iv) integration of soft and hard landscaping elements within and around the houses to absorb or lessen the dust particles entering into the building. Architects and housing developers also need occupant's inputs in their design to create healthy housing and environments. This brings to fore the necessity of integrating neighbourhood design method in practice through the inclusion of paved sidewalks, green and places for leisure to enhance occupant's health. This would need to be backed up with appropriate data obtained from the building occupants.

6. Limitations

This paper presents a study that is preliminary and cross-sectional in its design. The sample size used in the study is considered to be small, thereby posed some methodological limitations which could have affected the results. This agreed with observations made by Bruce, Perez-Padilla, and Albalak (2002) which reported in their findings that as a result of some limitations arising from methodological issues, some studies carried out on housing environments and health from the third world countries finds no significant relationship between them. Further, the equipment used to capture indoor environmental parameters of the investigated buildings could not capture the particulate matter continuously for 24 hours as anticipated due to constraints of electricity supply to power the equipment.

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Conflict of interests

The author declares no conflict of interest.

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Model Cities for Resilience: Climate-led Initiatives

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Sponge Cities;
Cities and Natural Disasters;
Cities and Climate Actions.

ABSTRACT

Paris Agreement of December 2015 was the last official initiative led by the United Nations (UN) as the driver of climate change mitigation. Climate change was hence linked with an increase in the occurrence of natural hazards. A variety of initiatives were consequently adopted under different themes such as sustainable cities, climate-friendly development, and low-carbon cities. However, most of the initiatives targeted by global cities with urban areas being the focus in terms of taking action against global warming issues. This is due to the structural and environmental features of cities characterized by being populated, as such, they not only generate a large number of carbon emissions but also happens to be the biggest consumer of natural resources. In turn, they create a microclimate, which contributes to climate change. Masdar City, for example, was designed as the first fully sustainable urban area, which replaced fuel-based energy with electric-based energy. China, as another example, introduced the Sponge Cities action, a method of urban water management to mitigate against flooding. Consequently, architects and urban planners are urged to conform to the proposals that would mitigate global warming. This paper, as a result, examines some of the models that have been internationally adopted and thereafter provide recommendations that can be implemented in large urban areas in Turkey, primarily in Istanbul.

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1. Introduction

Human beings experience different types of natural disasters during their lifetimes. Some types of natural disasters strike certain locations because of seasonal and natural deeds. For example, in the Atlantic Basin from the beginning of June to the end of November, there is a high possibility of a tropical cyclone strike, which is called a hurricane. The most prone areas, therefore, are the Atlantic coast and the Gulf of the United States, and the islands of the Caribbean. The season of cyclones in the South Pacific and the Indian Ocean is between November and April. Tropical cyclones striking the Northwest Pacific Ocean are called Typhoon and threaten the islands of Japan and the Philippines. Differently, the west coast of the United States is prone to

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earthquakes and wildfires rather than hurricanes. Countries including Turkey, Iran, Greece, and Italy are known as earthquake-prone countries because of their geological seismic structures. India, Bangladesh, Indonesia, and Thailand are countries exposed to river floods very often due to heavy rainfalls and their low-lying lands. These examples are to frame the natural reasons for some hazard types. Accordingly, natural disasters can be categorized into five groups: geophysical, biological, meteorological, hydrological, and climatological (Figure 1). Some types of hazards turn into disasters for a small area and a short period, such as earthquakes and volcanic eruptions. Some of the hazards under the categories of meteorological, hydrological, and climatological affect larger areas and most of the time last for a long period varying from days to years. Consequently, natural disasters are categorized based on their speed of happening as well. Droughts, changes in the amount of rainfall and the rise of sea level are among the slow-onset disasters that "that does not emerge from a single, distinct event but one that emerges gradually over time, often based on a confluence of different events" (Adamo, 2011). Slow-onset disasters are considered likely to have resulted in population displacement and migration mobility due to environmental challenges. Hence, they have social and economic effects in the long run since the movement becomes either temporary (that is, seasonal) or permanent in the case of environmental conditions that cannot be restored. Rapid-onset disasters, on the other hand, have an instant impact, although some allow for the early warning system. Earthquakes, for instance, cause severe destruction in the built environment in only a few seconds, and sometimes they trigger further disasters such as tsunamis, landslides, fires, and explosions (for example Fukushima Nuclear leakage in 2011). Nonetheless, they are considered rapid-onset disasters that require urgent intervention and preparation can simply improve the coping with strategies in most cases. Some geophysical disasters can cause hydrological disasters too. For example, a volcanic eruption emits a great amount of sulphur dioxide that the reaction in the atmosphere creates acid rains afterward (for example Kilauea eruption in 2018). However, not all geophysical disasters are bound to a hydrological, meteorological, or climatological disaster. The latter three can occur alone resulting from a serial formation of natural events. According to the EM-DAT Database in 2020 (Table 1), the total number of natural disasters reported around the world significantly increased between 1970 and 2019.

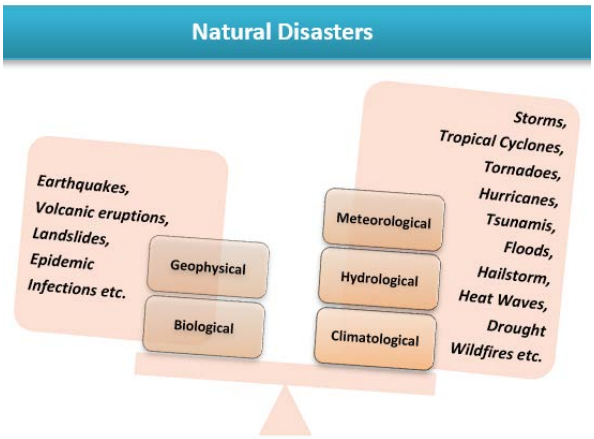

Figure 1. Types of natural disasters and their effect size.

Floods and extreme weather events have the largest shares among the others (including earthquakes, and landslides) and have witnessed a remarkable increase from the year 2000 and onwards. Extreme weather events, mostly refer to heat waves and hailstorms, where floods occur mainly due to extreme precipitation, coastal storms, and sea-level rise. Generally, the upsurge in the numbers of disasters reported can be explained by the fact that technology and communication have made it easier to undertake monitoring unlike before. However, the rise of the frequencies in the occurrence of floods and extreme weather events cannot be simply explained by this fact since other types of disasters (such as earthquakes and landslides) do not follow such an increasing frequency. This draws attention to climate change where research from the USA showed that since 1950, extreme precipitation events increased in 193 out of 244 cities across the country, particularly in the Southeast lands. This is explained by the fact that as global warming causes more evaporation from water resources (such as oceans and lakes), it results in the atmosphere containing 4% more water molecules than the usual average (Climate Central, 2019). The debate intensified after the 1990s, although the issue is mostly rooted back to the 19th century during the first industrial revolution. As such, it took decades to convince world populations and the respective governments that the concern was real since some events were accompanied by evidence.

Today, global temperature rise, warming oceans, shrinking ice sheets, glacial retreat, decreased snow cover, sea-level rise, declining arctic sea ice, extreme events and ocean acidification are deemed evidence of climate change by the National Aeronautics and Space Administration. Hence, climate change is a collective term and global warming is a large part of it. IPCC, as a result, reported that the global surface temperature will rise by between 1 to 3.5 Celsius degree by the year 2100. However, it was only between 2006 and 2015, when it increased by 0.87 Celsius degree. At this point, the Paris Agreement was introduced in December 2015 to campaign against global warming by keeping the rise of the global surface temperature below 2 Celsius degrees by the end of the current century. This goal is strongly linked with the prevention of greenhouse gas (GHG) emissions into the atmosphere, which mainly refers to carbon dioxide and methane gases. An early study by Tyndall in 1859 discovered that carbon dioxide significantly absorbs solar radiation (Hulme, 2009). Consequently, its accumulation in the atmosphere is responsible for global warming. Table 1 presents a summary of the natural disasters reported on the global scale between 1970 and 2019.

Table 1. Natural disasters were reported on a global scale between 1970 and 2019.

Year	Floods	Extreme weather	Drought	Earthquake	Landslide
1970	31	24	2	11	5
1975	17	28	-	4	5
1980	39	42	14	24	4
1985	58	51	3	22	6
1990	60	137	12	43	4
1995	94	81	6	26	16
2000	157	102	27	30	28
2005	193	130	20	25	13
2010	184	94	17	24	32
2015	160	118	28	23	20
2019	170	85	15	32	22

Source: Adapted with modifications from the EMDAT 2020 Database.

Because of the relationship between GHG emission, global warming and climate change (Figure 2), most of the environmental initiatives target the reduction of carbon dioxide emission as much as possible. The built environment makes a great contribution to the total GHG emissions worldwide. According to ISOCARP (2018), "cities occupy only 2% of the world's land surface, consume 75% of natural resources, produce 50% of global waste and account for 60-80% of GHG emissions". In more detail, IPCC (2014) reported that buildings' share in the total global final energy use accounted for 32 % and 19 % of energy-related GHG emissions (Lucon et al., 2015). The report also revealed that energy consumption is largely used for space heating both in residential and commercial buildings. This is followed by cooking in residential buildings and electricity use for powering equipment in commercial buildings (Figure 3). On a larger scale, urban areas' consumption of global final energy use ranges between 71% to 76% (Seto et al., 2014).

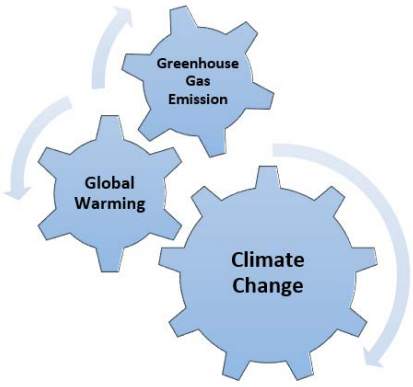

Figure 2. The interrelation between GHG emission, global warming, and climate change.

Needless to mention that the share must have risen in the past decade on the account of the number of building stock that increased towards the end of the year 2020. Urban built environment is therefore seen as a key driver in combatting climate change. IPCC, therefore, notes that adopting new technological options, changing design practices, and behavioural changes can lead to large reductions in building energy consumption. In this case, if it is a new building, such an initiative can result in an energy saving of up to 90%, and if it is a building with alterations, it can save up to 75% of its total energy consumption. Architects and urban planners should, therefore, use adopt a different paradigm that takes cognizance of the environmental impacts during the design to the construction process, and the potential contribution in energy consumption and GHG emission. The current plans and designs of buildings should, therefore, take into account the measures that would eliminate the anticipated environmental impacts. Figure 3 shows the shares in the final energy consumption in residential and commercial use.

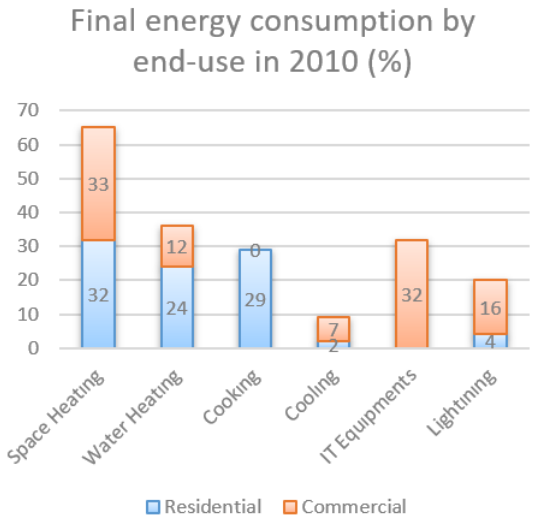

Figure 3. The chart shows the shares in the final energy consumption in residential and commercial use. Source: Adapted with modifications from IPCC (2014)

2. Materials and Methods

The generic design discourse has been updated since climate change has become a central focus in the built environment. A go-green revolution is, therefore, being promoted for cities(Grey, 2018). Accordingly, new radical cities are built, or existing ones undergo radical changes. For example, Low Carbon Liveable Cities Initiatives by the World Bank (2009) support the model of low-carbon cities in developing countries. Besides, eco-cities, zero carbon, or carbon-neutral cities are models being developed as a strategy for promoting the concept of a sustainable city.

This paper, therefore, reviews case studies of various 'new' urban approaches. The examples include the Masdar City project in Abu Dhabi, Sponge Cities interventions in Chinese cities, and further examples from different countries that aim to be carbon-neutral, self-energy sufficient and ecological cities ideally. The paper also highlights key features in the design of the projects and thereafter examines a list of strategies commonly adopted. The current study further reviews the cases from the qualitative approach, which focuses on the outstanding design features and their expected environmental benefit on residents. A conclusion is finally made on the most appropriate design.

3. Ideal Cities vs. Energy Consumption

3.1 Masdar City

In 2006, Abu Dhabi's authorities were motivated by the green energy concept and had the vision to prepare the Emirate for a possible post-oil energy era. Masdar City was planned to be a zero-carbon eco-city, which aimed to keep the amount of carbon emission at zero. To achieve this, the city adopted the vernacular Arabic architecture and utilized all the required cutting-edge technology through solar power panels to produce energy in sustaining the complex (Günel, 2019).

The City was planned to host 40 thousand people and 50 thousand commuters daily with the entire project was planned to be completed by the year 2016. Unlikely, in 2015 the population of the City was still only composed of graduates and students at the Masdar Institute and some employees that were less than two thousand (Lee, Braithwaite, Leach, & Rogers, 2016). However, the completion date of the project was delayed until 2030 due to the various crises and challenging conditions that affected the project. During the process, the project evolved, and the goal did not remain the same. Masdar City still plans to be a low-carbon city. In this context, the energy sources of the City were diversified into photovoltaic panels (53%), concentrated solar power (26%), evacuated thermal cube collector (14%), and waste reuse (7%) to provide it fully self-sustained (Afkhamiaghda, 2015). At the same time, more than 22-hectares-of-land are fully occupied

with solar panels which generate power to the City, needless to say, that local dust storms occasionally block the area. Apart from the benefits of the traditional Arabic city layout, which provides shade during the day over the streets and prevents overheating, the City was also built on a raised ground for 7-8 meters to maximize its exposure to the cooling winds and decrease the need for air conditioning. Waste management was as well significant for the project since the target was zero-waste. The waste was categorized under the categories of compostable bio-waste, non-recyclable, and recyclable (Manghnani & Bajaj, 2014). 96% of construction waste was either reused or recycled (Mezher, Dawelbait, & Tsai, 2016). In buildings, while energy consumption is 56%, that of clean water consumption is 54%, less than any other conventional building. Inflatable ETFE cushions were used on the Laboratory building facades to barrier the heat transfer from outside and the Arabic latticework was applied on the concrete facades to provide shade to the interiors (Patel & Griffiths, 2013).

Besides, all the buildings in the City must meet a minimum 3-Pearl rating according to the Estidama Pearl Building Rating System, which is Administered by the Abu Dhabi Department of Municipalities and Transport (3-Pearl Estidama rating is comparable to the LEED Gold international green building certification). Nevertheless, it remains arguable whether the Masdar City project was promoted to the extent that it seemed unrealistic or a failure to some. Nevertheless, by 2019, only 10% of the entire project had been completed. Although it was planned to be a car-free city by replacing fuel-based transportation system with driverless Personal Rapid Transit (PRT) system (Figure 4), today electric vehicles and shuttles actively on the City roads of (Patel & Griffiths, 2013). From the humanistic perspective, it has been observed that the process was purposefully government-controlled instead of taking the concerns and desires of the local community (Lau, 2012).

Buletti and des Noisetiers (2011) argued that the architecture of the city and the use of high-tech applications (for example facades and large roof decorated with solar panels) was to draw an attractive image for scientific community members, and the very polished renders were to attract the luxury-interested society members so that it creates its own selected gated community under an eco-city roof. Similarly, Cugurullo (2013) argued that the City was planned from a business aspect (mainly technology-based funds flow) leaving the social aspects behind. A study by Kherdeen (2016) also maintained that the timeline allowed for the project was too unrealistic that made it impossible for its objective to be attained owing to the lack of research in its development phase. Figure 4 shows the conception section of the Masdar HQ, the biggest office building in the City, and the distance by walk to LRT (light rail transport) and PRT.

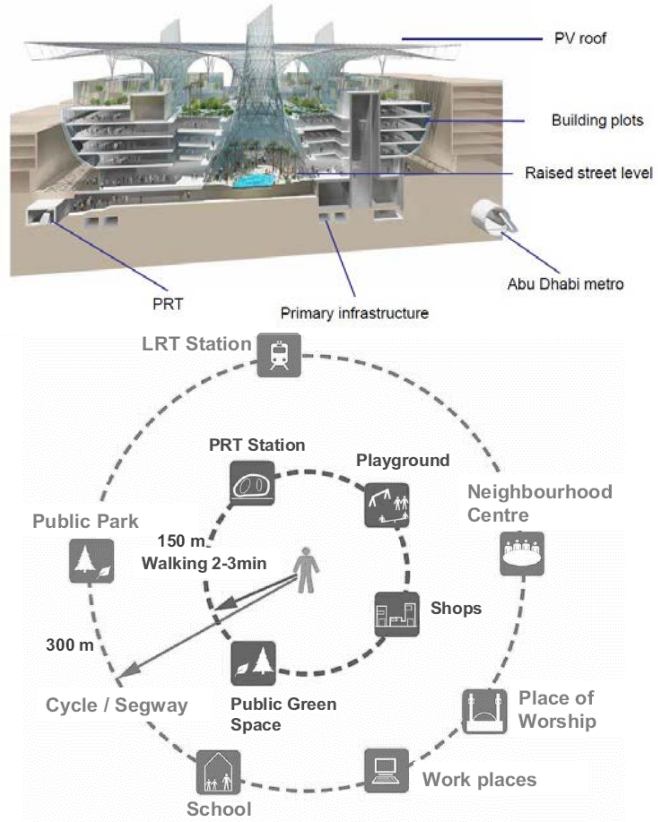

Figure 4. The conception section of the Masdar HQ, the biggest office building in the City and the distance by walk to LRT (light rail transport) and PRT (personal rail transport).

3.2 Chinese Eco-Cities

As the country that has the largest population, China makes attempts to solve the problems of urban settlements. In the past decades, the Chinese government channelled its economic resources into building sustainable cities, and eco-cities projects. By the year 2015, more than a hundred cities were planned to be transformed into eco-cities and more than 250 to be eco-city or low-carbon city (Caprotti, Springer, & Harmer, 2015). Dongtan eco-city

and Tianjin eco-city are the two examples that are highly discussed in the literature. Tianjin eco-city (Figure 5) is deemed the "flagship national eco-city Project" on the east coast of China. The project was jointly developed by the Chinese and Singaporean governments (Caprotti et al., 2015). The idea of the project was initiated in 2007, and by the end of 2008, the Master Plan of the City had been finalized. The City planned to be home to 350 thousand residents and also provide job opportunities for 190 thousand by 2020. The energy sources were diversified to include solar, geothermal, and wind. Like in Masdar City, a solar panel site was built outside the Tianjin eco-city to power the offices. Wind turbines were mounted to supplement the solar panels. Additionally, geothermal energy was introduced and used to power the administration building with 50 pumps. The electricity and the pumps were powered by the energy produced by the solar panels.

The waste management problem in bathrooms was solved with the use of ecological taps and toilet flushes that ensured minimum waste. Large lawn areas and porous ground allowed for the reuse of rainwater. For the cleanliness of the urban environment, the pneumatic rubbish collection system was configured. However, because the system was found complicated at first by the residents, they disliked it(Li, Bonhomme, & Deroubaix, 2018). The City's layout was planned with a walking distance of 400 meters to enable the residents to easily access public amenities, clinics, markets, kindergarten, and primary school. In this way, energy consumption based on transportation needs was diminished in the inner city (Yao & Chong, 2010). The public transportation network was established with light rails, hybrid and electric bus systems. For the residential building stock, high-rise buildings that had 20 to 30 stores were preferred. The land selected for the project development was mainly grey and brownfield areas (Chang, 2017).

Since Tianjin a city facing water scarcity, the Tianjin Municipality Ecological City Development has adopted local codes and regulations to force water conservation, water-saving technologies in seawater desalination, wastewater treatment, water reuse, and flood and storm management (World Bank, 2009) While Tianjin eco-city was realised, the development of Dongtan eco-city was, on the other hand, was postponed until. ARUP was consequently hired in 2005 to design and construct the project. It was aimed to have 60% less ecological footprint, 60% less energy consumption and to emit almost no carbon dioxide while producing 40% of the total energy required. The City was planned to have three villages to host 500 thousand people. In Dongtan, all vehicles in transportation would run on batteries or hydrogen fuel cells. An alluvial island was chosen for the development which was home to the migratory water birds. For the residential blocks, low-rise buildings (four to eight stories) were preferred, unlike Tianjin. Chang (2017) argued that the lessons learned from the failed dream of the Dongtan eco-city gave birth to a rather successful example, Tianjin. However, Caprotti et al. (2015) criticized that the project of Tianjin was a design with high reference to countries of Singapore and Taipei, fashioning the eco-city and thus, attracting people from a wealthy background. Figure 5 illustrates the view of Tianjin from the riverside.

Figure 5. The view of Tianjin from the riverside and the location map (Source: Google Maps).

3.3 Chinese Sponge Cities

Urban water management includes rainwater, groundwater, wastewater, and clean water management. The concept of Sponge Cities mainly focuses on water management regarding the control of rainwater, groundwater, and riverbeds. It is about preventing water-related disasters such as floods due to heavy rainfalls. The "sponge"

defines the process of absorbing water and control it through and release it when necessary. China launched the program in late 2014, to reuse 70% of rainwater. While by 2020, the goal was to achieve this in 20% of the cities, further, by 2030, the goal is to reach 80% of the cities across the country (Huang, Shen, & Mardin, 2019). Therefore, the project targets the urban areas, primarily under the risk of flooding. It first begins with harvesting the rainwater at the building scale. Roads and office buildings collect, purify, and reuse rainwaters. The goal is to decrease the pressure on the drainage system. Hence, the difference between eco-city and sponge city is that eco-city focuses on the energy consumption in all kinds, whereas sponge city focuses on the rainwater management to prevent possible flooding of the human settlements in cities. In 2015, 16 pilot cities were selected for implementation, including Wuhan, Chongqing, and Xiamen, and in 2016 another 14 cities were added to the list, including Beijing, Tianjin, Shanghai, and Shenzhen (Zevenbergen, Fu, & Pathirana, 2018). For example, Yanweizhou Park in Jinhua City, Zhejiang Province of China (Figure 6), is one of the examples designed by Dr. Yu Kongjian, founder and Principal Designer of Turenscape and Dean of the College of Architecture and Landscape Architecture at Peking University. To build a resilient park, the bridge was elevated above the ground based on a 200-year flood level and approaching to 700 m long, the bridge provides a connection of the island with no blockage during the wet season as well (Toh, 2018).

Figure 6. The view of Yanweizhou Park during the dry season on the left, wet season on the right. Source: (Toh, 2018).

To give another example, Yangtze Riverfront Park in Wuhan was completed in 2018. Wuhan had the worst rainfall events of its past 18 years from 2016. Since the river was the main reason for flooding, to achieve a resilient urban area, 7 km long Beach Park fully covered with vegetation was designed as a buffer zone between the buildings and the riverside. Because the river culture was very common in Wuhan, the Park created was designed as a promenade that the public would enjoy walking and skating.

Figure 7. The Riverside renders for both sides and the closer rendering of the area.
Source: Sasaki Associates (2020)

3.4 Low-Carbon Society and City

Japan started the move 'Low-Carbon Society' in 2013, and since then made 'City-to-City' collaborations with other Asian countries to exchange know-how technologies and to lead the process overseas. Today, there are 25 cities in Cambodia, India, Indonesia, Laos, Malaysia, Mongolia, Myanmar, Philippines, Thailand, and Viet Nam, which are co-operating with 12 Municipalities in Japan, including Hokkaido, Sapporo, Toyama, Fukushima, Kyoto, Kobe, Osaka, Kanagawa, Kawasaki, Yokohama, Tokyo, and Kitakyushu.

The cities in Japan are urged to take action according to the Act on Promotion of Global Warming Countermeasures. Japan's target is to reduce carbon emission by 26% by 2030, and 80% by 2050.

Yokohama city aims not only to reduce carbon emission but also to transform the city into a smart city. Yokohama was selected in 2010 as

the lead in Smart City Project, and after 2015 the city began to apply the measures, which target energy efficiency in the transportation network, improved disaster prevention capabilities, better environmental performance, and at last gain economic efficiency as well (Akagi, 2018). Based on the data from 2017, the energy industry contributes to carbon emission by 22%, commercial buildings by 21% and residential buildings by 22%. Transportation system contributes by 19% and various industry contribution is 11% (Akagi, 2018). Accordingly, the City aims to reduce GHG emission amount by 30% per person by 2025, and by 2050 the goal is to reach 60%. Regarding the built environment, the new buildings must meet the energy conservation standards, and to build greenhouses, low-interest loans are made available (UNESCAP, 2012). According to C40 International Initiative, the transportation network was planned to be adjusted based on non-fuel vehicles. The City provided two thousand electric vehicles and provided charging stations as well. Besides, across the borders of Yokohama city, solar power generation in 249 locations, wind power generation in 2 locations, hydropower generation in 3 locations, and biomass power generation in 6 locations will be implemented (C40 Cities, 2014). Nonetheless, the municipality was also aware of the fact that without informing the residents, the achievement cannot be realized. Hence, within a school project, 418 lectures were held for 35,000 participants to sensitize them about the change the city was about to experience.

4. Turkey and the Case of Istanbul

Turkey is the 20th largest GHG emitter in the world (Timperley, 2018). The main natural resource used for energy production is coal. There are 15 thermal plants across the country producing electricity power by consuming the coal reserves (Kiliç, 2006). However, as a developing country, Turkey imports other kinds of sources as well, including natural gas and oil, given that the country neighbours Iran, and close to Azerbaijan, Russia, as also the leading fossil energy exporter countries in the world. Other than coal, hydro dams are also electric energy providers of the country. Although the country could benefit from solar and wind energy, it does not have large energy plants. Differently, a nuclear plant is under construction in Akkuyu, Mersin, the south coast, since 2017 and is planned to start operation in 2023. A second plant is under bureaucratic progress for Sinop, the Black Sea coast. The third one in İğneada, the northwest coast, is still under design. In 2010, Turkey published a targeted to increase the production of electricity from renewable resources by 30% in 2023. Regarding transportation, the aim is to upscale renewable energy by at least 10% by 2023 (Timperley, 2018).

Turkey is an earthquake-prone country due to geophysical conditions. However, in the past decades, the country also began experiencing severe floods and landslides in the cities, due to climatological changes. Istanbul, as the largest metropolitan city in the country, experienced more often than before such disasters after heavy rainfalls. The floods are the result of the combination of the increased water flow in the Bosphorus and the insufficient underground stormwater drainage systems in the city (Figure 8). The densely built environment also prevents the flow of rainwater through the underground owing to the absence of green areas (Turoğlu, 2011). Although the city has experienced several flood events, the most memorable one was in September 2009. In this case, the Ayamama River basin overflowed, and the flood affected a large area, including the motorway as well as the settlements. The flood caused the death of 31 people (Reyes-Acevedo, Flacke, & Brussel, 2011).

Figure 8. The floods cause to the scenes that the citizens were neither familiar with nor prepared before (Istanbul).

5. Discussion and Conclusions

Sustainable projects are long-term projections, consequently, they require huge investments because they involve multiple stakeholders who invest and take an active role during their operation (Zhan, De Jong, & De Bruijn, 2018) The local authorities should hence recognise this fact. From the cited examples, it is now more apparent that the built environment forms a key determinant in climate change through carbon emission. As already observed, the first goal is to reduce this outcome. For that reason, the measures taken as a start should be to adopt an electricity-powered system in favour of fossil-based energy heating resources, mostly by operating solar panels. The second measure concerns water management. This is because although rainwater could be recycled and reused, it has the potential to attract disasters. In terms of increasing the consumption of clean water resources, rainwater should be managed, as in the case of Sponge Cities. Further, sea-level rise, as mentioned earlier, is a big problem for the seaside cities, in addition to the heavy rainfalls that cause an overflow in riverbeds. Hence, these cities should have a buffer zone in the form of the embankment to let the water inundate to a possible level and distance (based on the estimations of the previous years). The buildings in the city layout should, therefore, be sited according to this proposal in a re-study master plan. Besides, green parks and open areas with porous pavement should be designed so that the rain flows down through the ground.

Additionally, because transportation systems require a significant amount of energy, this should be replaced with hybrid systems, and more likely to be electrically powered. About Turkey (Table 2), the taxation system should be improved to promote the use of hybrid cars and electric cars. As such, fossil fuel-based vehicles in the public transport system should be replaced with hybrid and electric options. Just like in Japan, the urban community should be sensitized on their footprint on the environment by placing info-points around the central areas and possibly in the bus stops, and train stations.

Both thermal insulation and greywater systems should be promoted in buildings. Particularly, concerning new residential and office buildings, the amount of clean water supplied from the grid should be equal to the amount recycled and within the facility. In the same way, since electricity supply is largely dependent on the grid, solar panels should be built on rooftops and in the façade systems for the high-rise buildings. Through this way, the contractors and residents would be obliged to install such systems in the buildings, as opposed to the conventional systems since they are cheaper. Nevertheless, it is noteworthy to state that like in the example of Masdar City, instead of building a new settlement, which requires bigger budgets, improving the existing cities and their infrastructure would be the better option since there will also be ownership by residents who would, in the long run, want to experience an improved built environment. In conclusion, Table 2 shows the reasons why floods are frequent in Istanbul, the mega-city of Turkey.

Table 2. The of reasons to have floods frequently in Istanbul, the mega-city of Turkey.

Factors	Reasons
Buildings	The most densely used urban area, The seaside is the most valuable area (in terms of estate value), Mass concrete construction is widespread in the city, Which increases the heat felt and affect urban walkability, Use of natural gas, coal for heating is common for residential and official buildings, Building construction still follows conventional approaches, Building stock is largely old, hence use of air-conditioner is spread, Building Energy Performance is widely understood as heat insulation, and least as reduced electricity consumption, Consumption of clean water is dependent on the grid, reuse systems are very rare.
Infrastructure	Surrounded by the Black Sea, the Marmara Sea and Bosphorus. Suffer insufficient rain-drainage systems ends up with floods,

	Insufficient green lands in the urban layout that decrease the porosity of the ground, As a crowded city, metro lines are being expanded newly, but not the underground waterlines. People tend to use their cars instead of taking public transport,
Transportation	The largest number of vehicles in transportation, Fuel based car use has the largest percentage, hybrid cars are still new, in the market and electric charging stops are insufficient, Bicycle use is promoted only in few districts, bicycle riding paths do not exist in many districts.
Human behaviour	The largest population in the country, almost 16 million, Even in the dry summer season, people like to wash their cars to keep them clean without caring for resources, Women often wash carpets, Municipalities wash the streets.

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Conflict of interests
The author declares no conflict of interest.

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SIMURG_CITIES: Meta-Analysis for KPI's of Layer-Based Approach in Sustainability Assessment

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ABSTRACT

"SIMURG_CITIES" is the research and development project that is developed under the main project named SIMURG: "A performance-based and Sustainability-oriented Integration Model Using Relational database architecture to increase Global competitiveness of Turkish construction industry in industry 5.0 era", is a relational database model that is currently being developed in a dissertation for performance-based development and assessment of sustainable and sophisticated solutions for the built environment. This study aims to analyze the key performance indicators (KPIs) at «Cities Level» for the smart city concept that is referred to as «Layers» in the master project. KPIs for the concept of a smart city are determined by using the meta-analysis technique. Hence, the three most reputable urban journals issued from 2017 through 2020 are reviewed in this study. In addition to this, models of smart city frameworks/assessment tools/KPIs are reviewed within the context of this paper; environment, economy, and governance were found to have domain themes on urban sustainability according to the literature review. Consequently, efficient and integrated urban management, environmental monitoring and management, public and social services of urban development, and sustainability are found to be the most important dimensions in urban and regional planning. SIMURG_CITIES evaluation models for urban projects can use the findings of this paper.

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1. Introduction

With globalization, individuals living within the same community which has different demographics structures, and understanding of life have increased and also lifestyles and expectations of these individuals have changed. The characteristics of built

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environment-related value systems have differentiated utilizing individuals' age, culture, educational level, etc. Nevertheless, policymakers(individuals/companies/institutions/local authorities) have designed living spaces uniformly assuming there is a single type of individual according to their value systems. While policymakers are preparing urban policies, cities continue to grow depending on rent since there are no tools to help rational decision making and decision support systems that can be measured. At this point, performance-based design and building of built environments to evaluate alternatives in a comparative way seems to have increased attractiveness for individuals /companies /institutions / local authorities of policymakers. As a result of the examinations made, it has been concluded that the model which will be developed for the solution of the identified problem must include and reveal the components of the solution in the dimensions stated by Kanoğlu et al. (2018).

The United Nations (UN) assumed seventeen Sustainable Development Goals (SDGs) that are aimed to "stimulate action over the next 15 years in areas of critical importance for humanity and the planet" in the last publication of the global sustainable development agenda, "Transforming Our World: The 2030 Agenda for Sustainable Development". Features as part of the targets referred to 3rd goal on "good health and well-being", 4th goal on "quality education", 8th goal on "economic growth", 9th goal on "innovation and infrastructure", and 11th goal on "sustainable cities and human settlements" (United Nations, 2015). *Sustainability* is the main concept among those that can be achieved by the integrated use of the other key concepts which are *innovation, competitiveness, competition by design, performance-based building production process, integration of building production processes and interoperability supported by BIM (Building Information Modelling) and information classification systems* (Kanoğlu et al., 2018). These concepts seem to be the key factors to design an integrated model that increases the competitive advantage of the national construction industry in the global market. Additional concepts that are not of less importance compared with the first set are transparency, accountability, and consistency. What the individuals, institutions, companies, and society need in Turkey are the practical and accessible tools that provide these concepts at all levels of decision-making. The problem is the lack of these tools that allow the governments and municipalities to propose suitable identities defined by the concepts or "layers" such as historical/smart/green/slow/safe/resilience etc, that are presented by specific KPIs and associated weights, for their built environments at all levels and to develop consistent policies for this purpose that helps individuals in matching up their attributes with social, cultural, economic, educational, etc., characteristics of the built environment they are supposed to live. Many more sub-components such as management, planning, energy, transportation, infrastructure resources, etc. of cities are needed to make a sustainable performance-based assessment, as well as KPI's set, should be determined from its parameters for the design to be aesthetic, compatible with user needs and functions.

SIMURG: "A performance-based and Sustainability-oriented *I*ntegration *M*odel *U*sing *R*elational database architecture to increase *G*lobal competitiveness of the Turkish construction industry in industry 5.0 era" is integrated with the subprojects conducted by Kanoğlu et al. (2018) within the SIMURG_ALKU&ITU Virtual Laboratory, established on the Research Gate Scientific Communication Platform (https://www.researchgate.net/profile/Alaattin_Kanoglu). Kanoğlu et al. (2018) designed the open-ended project that improvement for concerned models at all hierarchical levels of "performance-based design and construction" of the built environment manner in various sub-projects in two supplementary fields, i.e., "product" and "process" dimensions. "Building components", "building elements", "building premises", "buildings", "projects", "lands", "quarters", "settlements", "counties" and "cities" levels on "product side" and "operations", "projects", "departments", "firms", "groups of firms", "sectors", "national economies" and "global economy" levels on "process side" are the hierarchical levels of these dimensions. All the levels are required, specific KPIs and weights are determined together with organisational, computational, and computer models are designed. SIMURG_CITIES, the relational database model that is currently being

conducted by Ülker under the supervision of Kanoğlu et al. (2018) in her dissertation entitled SIMURG_CITIES: "A Performance-Based Integrated Model for Design and Evaluation of Sustainable and Sophisticated Solutions at Cities Level: Determination of Key Performance Indicators and Principles of Model at Conceptual Dimension". The main goal of the project is to determine the KPIs of performance of built environments at the city level in terms of the combinations of level-specific and layer/concept specific KPIs in both expert and user point of views and integrate the findings with SIMURG_INTEGRATED, the final output of the master project. This paper aims to analyse and determine the KPIs at "Cities Level" for the smart concept that is referred to as "Layers" in the master project. Also, the other aim of the paper is to review Models of smart city frameworks/assessment tools/KPIs on urban development and sustainability owing to the literature review.

2. Materials and Methods

The conceptual framework of this research is based upon an analysis of KPIs for the smart city concept. Meta-analysis is used to make a classification of the literature in the study. It also purposes to allow for a better understanding of the smartness of an urban framework acquired with the augmented use of sustainable thinking, particularly regarding urban studies. Hence, at first, this research demonstrates the descriptions of concepts and hypothetical basics of smart cities. Literature review link to the papers and researches is submitted, with the keywords "smart cities" or "smart city" and its integration with terms regarding urban planning and city assessment/framework/performance indicator/KPI. The literature review on the background of the sustainability approach indicated that research referring in related to the urban framework is based on the headings of "smart cities" or "digital cities". The research was carried out through a search of libraries and scientific databases, particularly Taylor & Francis Online, Scopus, Science Direct, Web of Science and the most respected urban journals, Cities, Journal of Urban Technology, Sustainable Cities and Society for the period of 2017-2020 to gather information and systematically review the hypothetical literature. As a result, fifty relevant papers were selected from these journals to analyse, determine, and categorize the concept of smart cities and their KPIs. The writers, subjects and methodologies of the reviewed fifty papers are presented in the Table 1 and 2. The purpose is to allow for better practical and accessible tools/performance-based assessment that provides this concept in all levels of decision-making in the future.

Table 1. Papers associated with KPIs of Smart City that have been issued in Urban Literature during 2017-2020.

Writers	Year	Journal	Subject	Research Methodology
Lam & Yang	2020	Cities	PPP for SC projects	Multi-attribute utility analysis
Wataya & Shaw	2019	Cities	Measuring soft assets in SCs development	Co-value creation evaluation
Molinillo et al.	2019	Cities	Measurement of SC communication via SM	Digital content analysis
Montalto et al.	2019	Cities	Measurement of the cultural vitality of ECs	An empirical approach
Huovila et al.	2019	Cities	Standardized indicators for sustainable SCs	Comparative analysis
Lam & Ma	2019	Cities	Identifying potential pitfalls in SCs development	An exploratory study
Heaton & Parlikad	2019	Cities	Infrastructure assets in SC framework	A conceptual framework
Shmelev & Shmeleva	2019	Cities	Multidimensional sustainability assessment for SC	Performance benchmarking
Yigitcanlar et al.	2018	Cities	Multidimensional sustainability assessment for SC	A systematic literature review
Ruhlandt	2018	Cities	Governance of SCs	A systematic literature review
Anthopoulos	2017	Cities	Performance analysis of international SC cases	A multi-methods approach
Navarro et al.	2017	Cities	ICT use and capability on SCs	Component analysis
Ahvenniemi	2017	Cities	Assessment framework for sustainable SCs	Performance benchmarking

Gessa & Sancha	2020	Journal of Urban Technology	Assessment framework for environmental in SC	Multiple case study research
Kiuru & Inkinen	2019	Journal of Urban Technology	E-Capital and economic growth in urban areas	An empirical approach
Costa-Liberato et al.	2018	Journal of Urban Technology	Digital Technology in Smart Tourism	A case study research
Falco et.al.	2018	Journal of Urban Technology	"Infostructure" approach to urban mobility	A case study research
Yigitcanlar & Kamruzzaman	2019	Journal of Urban Technology	SCs and Mobility	Multiple regression analysis
Fernandez-Anez et al.	2018	Journal of Urban Technology	Assessment framework of SC projects	Multiple case study research
Deal et al.	2017	Journal of Urban Technology	Urban resilience and planning support systems	A systematic literature review
Wong et al.	2017	Journal of Urban Technology	Knowledge structures of City ISs	Multiple case study research
Pak et al.	2017	Journal of Urban Technology	Socio-Demographic inequality in CP	A descriptive analysis
Joss et al.	2017	Journal of Urban Technology	Smart Citizen	A discourse analysis

PPP: Public-Private Partnerships, SC: Smart City, SM: Social Media, ECs: European cities, Iss: Innovation Systems, CP: Civic participation.

Table 2. Papers associated with KPIs of Smart City that has been published in Urban Literature from 2017 to 2020 (continued).

Writers	Year	Journal	Subject	Research Methodology
Yang et al.	2020	Sustainable Cities and Society	Smart Transportation	A coupled simulation method
Shapsough et al.	2020	Sustainable Cities and Society	Smart Energy	Performance measurement
Tang et al.	2020	Sustainable Cities and Society	Smart Transportation	Machine learning methods
Deveci et al.	2020	Sustainable Cities and Society	Assessment framework of SC projects	Interval Agreement Method
Sáez et al.	2020	Sustainable Cities and Society	Sustainbale City performance	Performance benchmarking
Sharifi	2020	Sustainable Cities and Society	SC assessment tools and indicator sets	Performance measurement
Yigitcanlar et al.	2019	Sustainable Cities and Society	Smart and sustainable cities	A systematic literature review
Karji et. al.	2019	Sustainable Cities and Society	Assessment of Social Sustainability Indicators	A case study research
Ghofrani et al.	2019	Sustainable Cities and Society	Smart building	Neural Networks approach
Akande et al.	2019	Sustainable Cities and Society	Smart Sustainbale City performance	Component analysis
Horgan & Dimitrijević	2019	Sustainable Cities and Society	Smart Citizen	A case study research
Nitoslawski et al.	2019	Sustainable Cities and Society	Smart Environment	A literature review
Walnum et al.	2019	Sustainable Cities and Society	Smart Energy	Multi-attribute decisionmaking
Mattoni et al.	2019	Sustainable Cities and Society	Smart Energy	Performance measurement
Zhu et al.	2019	Sustainable Cities and Society	Smart Energy	Machine learning methods
Michalec et al.	2019	Sustainable Cities and Society	Smart Environment	A discourse analysis
Zhang et al.	2018	Sustainable Cities and Society	Performance Evaluation for Smart Transportation	TOPSIS, A case study
Manupati et al.	2018	Sustainable Cities and Society	Urban renewal under SCs mission	Multi-criteria decision making
Ahmad & Chan	2018	Sustainable Cities and Society	Smart Energy	Machine learning methods
Silva et al.	2018	Sustainable Cities and Society	Sustainable SCs	A literature review
Alkhalidi et al.	2018	Sustainable Cities and Society	Smart Environment	The energy evaluation method

Aghamolaei et al.	2018	Sustainable Cities and Society	Performance Evaluation for Smart Energy	The energy evaluation method
Dall'O' et al.	2017	Sustainable Cities and Society	SC assessment tools and indicator sets	Performance measurement
Bibri & Krogstie	2017	Sustainable Cities and Society	Sustainable SC assessment tools/indicator sets	A systematic literature review
Hukkalainen et. Al.	2017	Sustainable Cities and Society	Smart Energy	Holistic energy analysis
Poggi et al.	2017	Sustainable Cities and Society	Performance Evaluation for Smart Energy	A case study research
Massana et al.	2017	Sustainable Cities and Society	Performance Evaluation for Smart Energy	A case study research

PPP: Public-Private Partnerships, SC: Smart City, SM: Social Media, ECs: European cities, Iss: Innovation Systems, CP: Civic participation.

3. Results: Meta-**Analysis for KPI's of Layer**-Based Approach in Sustainability Assessment

This section elaborates on the reviewed fifty papers in the literature and seven key themes and forty-four sub-themes/dimensions which are referred to in the last studies by Sharifi (2019, 2020) for the smart city assessment. The "typology of smart city evaluation tools and indicator sets" of Sharifi (2019, 2020) is used as a base for the meta-analysis table. Specific KPIs determined for each paper were marked in the meta-analysis table according to relevant themes or sub-themes/dimensions which were conducted topics in the papers. The findings of the meta-analysis are indicated in Tables 3, 4, and 5 that show the ratings of themes and sub-themes/dimensions related KPIs of a smart city in urban literature. The rating of seven themes for related KPIs of the smart city in the literature (Table 6), the major result of this research is that; environment, economy, governance-institutional, and data management is found to be the most important themes in urban and regional planning. Besides, the themes which are people, living and mobility (transport & ICT) need to become as important as the other themes.

Table 3. Themes and Sub-themes of the reviewed papers on Urban Literature.

Sharifi (2019) Assessment Tools & KPIs for Smart Cities		Relevant Studies for KPIs in Literature (2017-2020)																
Theme	Dimension	Lam & Yang (2020)	Wataya & Shaw (2019)	Molinillo et al. (2019)	Montalto et al. (2019)	Huovila et al. (2019)	Lam & Ma (2019)	Heaton & Parlikad (2019)	Shmelev & Shmeleva (2019)	Yigitcanlar et al. (2018)	Ruhlandt (2018)	Anthopoulos (2017)	Navarro et al. (2017)	Ahvenniemi (2017)	Gessa & Sancha (2020)	Kiuru & Inkinen (2019)	Costa-Liberato et al. (2018)	Falco et.al. (2018)
Economy	Innovation/innovation culture		√		√	√		√	√	√	√	√	√	√		√	√	
	Knowledge economy		√			√		√	√	√		√	√	√		√	√	
	Entrepreneurship				√	√		√	√	√	√	√	√	√		√		
	Finance	√				√		√	√	√		√	√	√		√		
	Tourism			√		√			√	√		√	√	√		√	√	
	Employment				√	√		√	√	√		√	√	√		√	√	
	Local & Global Interconnectedness	√			√	√			√	√		√	√	√		√		
	Productivity and efficiency		√			√		√	√	√	√	√	√	√		√		
	Flexibility of the labor market				√	√		√	√	√		√	√	√		√		
	Impacts	√	√		√	√			√	√		√	√	√		√		√
People	Education/ lifelong learning		√		√	√	√	√	√	√		√	√	√		√		
	Level of qualification/ ICT skills		√	√	√	√	√	√	√	√		√	√	√		√		√
	Cosmopolitanism/ open mindedness		√		√	√		√	√	√		√	√	√		√		
Governance -institutional	Visioning and leadership	√	√			√	√	√	√	√	√	√	√	√			√	√
	Legal and regulatory frameworks		√		√	√	√		√	√	√	√	√	√				
	Participation		√		√	√	√	√	√	√	√	√	√	√				
	Transparency	√	√		√	√			√	√	√	√	√	√				√
	Public and social services	√	√	√	√	√	√	√	√	√	√	√	√	√		√	√	√

	Efficient & integrated urban management	√	√			√	√		√	√	√	√	√	√		√	√
Environment	Environmental monitoring & management	√				√		√	√	√	√	√	√	√	√		√
	General infrastructure	√			√	√			√	√		√	√	√	√		√
	Built environment/planning and design				√	√			√	√		√	√	√	√		
	Materials					√			√	√		√	√	√	√		
	Energy resources	√				√			√	√		√	√	√	√		
	Water resources	√				√			√	√		√	√	√	√		
	Waste (solid waste, waste water, sewage)	√				√			√	√		√	√	√	√		
	Environmental quality/pollution	√				√			√	√		√	√	√	√		
Living	Social cohesion/inclusion		√	√	√	√		√	√	√		√	√	√		√	√
	Equity and justice		√		√	√		√	√	√		√	√	√			
	Cultural development		√		√	√		√	√	√		√	√	√		√	
	Housing/livelihood quality					√		√	√	√		√	√	√			
	Healthcare	√				√		√	√	√		√	√	√			
	Safety and security	√				√		√	√	√		√	√	√			√
	Convenience and satisfaction/ well-being		√		√	√		√	√	√	√	√	√	√		√	√
Mobility (Transport & ICT)	Transport infrastructure				√	√			√	√		√	√	√			√
	Transportation management	√	√			√	√		√	√	√	√	√	√		√	√
	ICT infrastructure					√	√		√	√		√	√	√		√	√
	ICT management		√			√	√		√	√	√	√	√	√		√	√
	ICT accessibility				√	√	√		√	√		√	√	√		√	√
Data management	Data openness	√	√			√			√	√	√	√	√	√	√		√
	Sensing and collecting	√	√			√		√	√	√	√	√	√	√	√		√
	Judging (analytics)	√	√			√			√	√	√	√	√	√	√		√
	Reacting	√	√			√		√	√	√	√	√	√	√	√		√
	Learning	√	√			√			√	√	√	√	√	√	√		√

Table 4. Themes and Sub-themes of the reviewed papers in Urban Literature (continued).

Sharifi (2019) Assessment Tools & KPIs for Smart Cities		Relevant Studies for KPIs in Literature (2017-2020)																
		Yigitcanlar & Kamruzzaman (2019)	Fernandez-Anez et al. (2018)	Deal et al. (2017)	Wong et al. (2017)	Pak et al. (2017)	Joss et al. (2017)	Yang et al. (2020)	Shapsough et al. (2020)	Tang et al. (2020)	Deveci et al. (2020)	Sáez et al. (2020)	Sharifi (2020)	Yigitcanlar et al. (2019)	Karji et. al. (2019)	Ghofrani et al. (2019)	Akande et al. (2019)	Horgan & Dimitrijević (2019)
Theme	Dimension																	
Economy	Innovation/innovation culture		√		√		√					√	√		√		√	
	Knowledge economy		√			√						√	√				√	
	Entrepreneurship		√									√	√		√		√	
	Finance		√								√	√	√		√		√	
	Tourism		√									√	√				√	
	Employment		√		√						√	√	√		√		√	
	Local & Global Interconnectedness		√									√	√		√		√	
	Productivity and efficiency	√	√		√		√		√	√	√	√	√	√	√	√	√	√
	Flexibility of the labor market		√									√	√				√	
	Impacts		√								√	√	√		√	√	√	√
People	Education/ lifelong learning		√				√					√	√				√	√
	Level of qualification/ ICT skills	√	√	√		√	√					√	√				√	√
	Cosmopolitanism/ open mindedness		√				√					√	√				√	√
Governance-institutional	Visioning and leadership	√	√	√	√	√					√	√	√	√	√		√	√
	Legal and regulatory frameworks		√									√	√				√	√
	Participation		√				√					√	√				√	√

	Transparency		√									√	√				√	√
	Public and social services		√	√	√	√	√	√	√		√	√	√			√	√	√	√
	Efficient & integrated urban management	√	√	√	√	√	√	√	√	√	√	√	√			√	√	√	√
Environment	Environmental monitoring & management		√		√	√	√	√	√		√	√	√	√	√	√	√	√	√
	General infrastructure		√					√	√		√	√	√			√	√	√	
	Built environment/planning and design		√			√		√	√			√	√			√	√	√	
	Materials		√			√		√	√			√	√			√	√	√	
	Energy resources		√					√	√		√	√	√			√	√	√	
	Water resources		√					√	√			√	√			√	√	√	
	Waste (solid waste, waste water, sewage)		√						√		√	√	√			√	√	√	
	Environmental quality/pollution		√					√	√		√	√	√			√	√	√	
Living	Social cohesion/inclusion	√	√			√	√					√	√					√	
	Equity and justice		√				√		√			√	√					√	
	Cultural development		√				√					√	√					√	
	Housing/livelihood quality		√				√					√	√					√	
	Healthcare		√				√					√	√					√	
	Safety and security		√				√					√	√			√		√	
	Convenience and satisfaction/ well-being	√	√			√	√				√	√	√			√	√	√	√
Mobility (Transport & ICT)	Transport infrastructure	√	√					√	√	√	√	√	√	√	√			√	
	Transportation management	√	√	√	√		√	√	√	√	√	√	√	√	√			√	
	ICT infrastructure	√	√	√		√			√	√	√	√	√	√	√	√	√	√	
	ICT management	√	√	√	√	√			√	√	√	√	√	√	√	√	√	√	
	ICT accessibility	√	√	√	√	√			√	√	√	√	√	√	√	√	√	√	
Data management	Data openness	√	√	√	√			√	√	√	√	√	√	√				√	
	Sensing and collecting	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	
	Judging (analytics)	√	√	√	√	√		√	√	√	√	√	√	√				√	
	Reacting	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	
	Learning	√	√	√	√	√		√	√	√	√	√	√	√				√	

Table 5. Themes and Sub-themes of the reviewed papers in Urban Literature (continued).

Sharifi (2019) Assessment Tools & KPIs for Smart Cities		Relevant Studies for KPIs in Literature (2017-2020)																	
Theme	Dimension	Nitoslawski et al. (2019)	Walnum et al. (2019)	Mattoni et al. (2019)	Zhu et al. (2019)	Michalec et al. (2019)	Zhang et al. (2018)	Manupati et al. (2018)	Ahmad & Chan (2018)	Silva et al. (2018)	Alkhalidi et al. (2018)	Aghamolaei et al. (2018)	Dall' O' et al. (2017)	Bibri & Krogstie (2017)	Hukkalainen et. Al. (2017)	Poggi et al. (2017)	Massana et al. (2017)	Total for dimensions	Total for themes
Economy	Innovation/innovation culture							√					√	√				22	219
	Knowledge economy							√		√			√	√				19	
	Entrepreneurship							√					√	√				18	
	Finance							√		√			√	√				19	
	Tourism							√					√	√				18	
	Employment							√					√	√				20	
	Local & Global Interconnectedness							√					√	√				17	
	Productivity and efficiency	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	40	
	Flexibility of the labor market							√					√	√				16	
	Impacts	√		√	√	√		√	√	√	√	√	√	√	√	√		32	
People	Education/ lifelong learning	√						√					√	√				21	68
	Level of qualification/ ICT skills	√					√	√					√	√				27	
	Cosmopolitanism/ open mindedness	√						√					√	√				20	
Governance -institutional	Visioning and leadership					√	√	√		√	√	√	√	√	√	√	√	36	184
	Legal and regulatory frameworks							√					√	√				18	
	Participation	√	√	√	√	√	√	√		√			√	√				27	
	Transparency							√					√	√				19	
	Public and social services		√	√	√	√		√				√	√	√	√	√		40	
	Efficient & integrated urban management	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	44	
Environment	Environmental monitoring & management	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	41	264
	General infrastructure	√	√	√	√	√		√	√	√	√	√	√	√	√	√	√	34	

	Built environment/planning and design	√	√	√	√	√		√	√	√	√	√	√	√	√	√	√	32	
	Materials	√	√	√	√	√		√	√	√	√	√	√	√	√	√	√	31	
	Energy resources	√	√	√	√	√		√	√	√	√	√	√	√	√	√	√	32	
	Water resources	√	√	√	√	√		√	√	√	√	√	√	√	√	√	√	31	
	Waste (solid waste, waste water, sewage)	√	√	√	√	√		√	√	√	√	√	√	√	√	√	√	31	
	Environmental quality/pollution	√	√	√	√	√		√	√	√	√	√	√	√	√	√	√	32	
Living	Social cohesion/inclusion							√					√	√				22	148
	Equity and justice							√					√	√				18	
	Cultural development							√					√	√				18	
	Housing/livelihood quality							√					√	√				15	
	Healthcare							√		√			√	√				17	
	Safety and security							√		√	√	√	√	√				21	
	Convenience and satisfaction/ well-being		√	√	√	√	√	√	√	√	√	√	√	√	√		√	37	
Mobility (Transport & ICT)	Transport infrastructure						√	√		√		√	√	√	√			26	163
	Transportation management			√	√		√	√		√		√	√	√	√			35	
	ICT infrastructure	√		√	√	√	√	√		√		√	√	√				32	
	ICT management	√		√	√	√	√	√		√		√	√	√			√	36	
	ICT accessibility	√		√	√	√	√	√		√		√	√	√				34	
Data management	Data openness	√			√	√		√		√		√	√	√			√	32	180
	Sensing and collecting	√			√	√		√	√	√		√	√	√	√	√	√	40	
	Judging (analytics)	√			√	√		√	√	√		√	√	√			√	34	
	Reacting	√			√	√		√	√	√		√	√	√	√	√	√	40	
	Learning	√			√	√		√	√	√		√	√	√			√	34	

Table 6. Ratings of 7 Key Themes for related KPIs of Smart City in Urban Literature

Themes	Ratings
Environment	264
Economy	219
Governance-institutional	184
Data management	180
Mobility (Transport & ICT)	163
Living	148
People	68

Table 7. Highest and lowest 10 ratings of Dimensions for related KPIs of Smart City in Urban Literature.

Dimensions	Ratings	Dimensions	Ratings
Efficient & integrated urban management	44	Housing/livelihood quality	15
Environmental monitoring & management	41	Flexibility of the labor market	16
Public and social services	40	Tourism	16
Productivity and efficiency	40	Healthcare	17
Reacting	40	Local & Global Interconnectedness	17
Sensing and collecting	40	Cultural development	18
Convenience and satisfaction/ well-being	37	Legal and regulatory frameworks	18
ICT management	36	Equity and justice	18
Visioning and leadership	36	Entrepreneurship	18
Transportation management	35	Finance	19

The highest and lowest ten ratings of forty-four dimensions for related KPIs of a smart city in the literature review are defined in Table 7. The other critical result of this research is efficient and integrated urban management, environmental monitoring and management, public and social services, productivity and efficiency and data management in urban development and sustainability are found to be the highest important dimensions. However, housing/livelihood quality, the flexibility of the labour market, smart tourism and smart healthcare are found to be the lowest ratings of dimensions. Smart/sustainable city planning has been revealed for the development of the lives of urban citizens and increasing civic

services/assets; also, given the closeness of modern technology, citizens' requirements and tools of interacting with their regional administrations is changing (Nitoslawski et al., 2019). At this critical point of change, cultural development, innovation, and entrepreneurship are the main dimensions to be considered. Since, culture is a concept that social, emblematic, and economic implications can mention people's customs, religions, and attitude, or economic activities based on symbolic values, artistic creation and creative skills also are a key for involved improvement, strengthening social ties and solidarity, and promoting innovation and creativity (Montalto et al, 2019).

4. Discussions

Modern cities tackle numerous economic, social, and spatial troubles, together with which they perform in an extremely volatile environment, which pushes them to seek an optimum development model. Nowadays, countless concepts/models (such as eco/ green/ compact/ smart/ slow/ resilient/ agile/ sustainable city etc.) of urban development have been discussed by researchers. In this section, the model/concept of smart city frameworks/performance indicators/assessment tools is researched and discussed in detail in the literature.

Cities act a crucial part socioeconomically and environmentally at a global level. The city infrastructure appeals to numerous people looking at the advantages of urbanisation over the conventional rural lifestyles inside various cultural contexts. The United Nations (UN) estimates that almost 7 billion people will inhabit in urban fields by 2050 (Streitz, 2015). Some other 1.3 million people around the world move into a city every week (Carter, 2020). Consequently, cities and their executives are meeting myriad difficulties and opportunities as their facilities and infrastructure are placed under ever enhancement levels of pressure (Breetzke and Flowerday, 2016). A rising trend is that manage the impact of these difficulties and opportunities in the usage of Information and Communication Technology (ICT) among an accessible integrated infrastructure for a concept of smart city (Ismagilova et al., 2019). Numerous cities are focusing their struggles to be "smarter" by using ICT to develop different ways of city management and operation, including regional traffic control, offer upscale life for people, transportation, economy, on-line applications of public services and environment (Li et al., 2017). Smart cities are innovations for the improvement of targets in the quality of life and development by the utilization of smarter approaches and technology (Lim et al., 2019). Smart cities have been researched extensively for almost three decades and there are many ways of looking at them. Smart city studies first arose in the year 1992 in which "The Technopolis Phenomenon: Smart Cities, Fast Systems, Global Networks" (Gibson et al., 1992). Then, Graham and Marvin (1996) began the research of the link between ICTs and urban fields with "Telecommunications and the City". Some studies in this recent field of knowledge are from Mitchell, 1995, 1999, 2003; and Castells, 1996). In the early 2000s as the best efficient research was "urban ICT studies", Graham (2004) accomplished to research "the complex and poorly understood set of relationships between telecommunications and the development, planning and management of contemporary cities". In the study of ICT-driven urban development and innovation have engaged the attention of researchers (Mora et al., 2017). The key centre of smart cities is on the act of ICT infrastructure. The plenteous environmental concerns as a significant motive of urban development at the part of relational/social capital and education/human capital (Komninos, 2002; Shapiro, 2008; Deakin, 2010).

Many definitions for "Smart Cities" in use globally, but smart city defines as "a new concept and a new model, which applies the new generation of information technologies, such as the internet of things, cloud computing, big data and space/geographical information integration, to facilitate the planning, construction, management and smart services of cities" according to SAC (ISO/IEC 2015). In literature, meanwhile, there is not any certain description of a smart city, a few basic dimensions of a smart city have been described (Giffinger et al., 2007; Fusco Girard et al., 2009; Van Soom, 2009). These dimensions cover "smart" governance/environment/mobility/economy/living/people. Briefly, "education" (e.g., e-governance or e-democracy), "technical infrastructure" (e.g., transportation or logistic), "industry" (e.g., business parks or districts), "participation" (e.g., government

administration, citizens), and various "soft factors" (e.g. security/safety, green, efficient and sustainable energy) are defined in the literature regarding smart city (Giffinger et al. 2007; Lombardi et al. 2012). In addition to them, Anthopoulos (2015) and Anthopoulos et al., (2016) have defined seven utilization areas of smart cities: "resource, transportation, urban infrastructures, living, government, economy, and coherency" thus they founded the theoretical structure of smart cities. While academics maintain to qualify smart cities as a recent and up-and-coming subject of research, the study of conceptualising and describing is still on-going (Townsend, 2013; Kitchin, 2014; Christopoulou et al., 2014; Greco and Cresta, 2015; Albino et al., 2015; Fernandez-Anez, 2016). On the other hand, the technology-focused vision of smart cities generally positions smart cities like cash cow and expects to produce a lot of money (Zanella et al., 2014). This rising market provides an opportunity for various growth initiatives, especially in a period of recession (Paroutis et al., 2014), big firms such as ABB, Fujitsu, IBM apply information and communication technologies as tools for smart-city development to motivate urban innovation. Nevertheless, this "corporate smart-city model" is condemned since it has not successfully explained the cultural and social developments of smart-city manner except for technological terms (Mora et al., 2017). Regarding this censure, Shin (2010) showed the failure of this model empirically and highlighted the shortcomings of the firm and technology-focused development for smart cities. Likewise, Shwayri (2013), Townsend (2013), Yigitcanlar & Lee (2014) and Yigitcanlar (2016) reported in some samples of these smart cities. On the other hand, from the recent studies, a holistic approach of smart cities has risen to base on human-centric vision ovation, the balanced integration of economic, social, cultural, technological, environmental, and human sides (Townsend, 2013; Hemment and Townsend, 2013; Komninos, 2014; Christopoulou et al., 2014; Angelidou, 2014; Concilio and Rizzo, 2016; Hollands, 2015, 2016). After all Mora et al., 2017 have underlined that "the knowledge necessary to understand the process of building effective smart cities in the real world has not yet been produced, nor have the tools for supporting the actors involved in this activity". In a nutshell, smart cities have factors such as "community", "technology", "policy"; the inclusive conceptual vision of the framework centres on finding the results in the development areas, i.e., "economy", "society", "environment", "governance" which are associated with five results "productivity", "sustainability", "accessibility", "wellbeing", "liveability", "governance" (Yigitcanlar et al., 2018). In addition to them, Sharifi (2019, 2020) has examined the strengths and weaknesses by evaluating thirty-four topics/schemes between smart city indicators. The results have shown that the widely known topics/themes are: "economy", "people", "governance", "environment", "mobility", "living" and "data".

5. Conclusions

SIMURG_CITIES, the relational database model of performance-based development and evaluation of built environment entities at cities level with an emphasis of "sophisticated solutions" such as slow, green, safe, smart, resilient, etc. in a comparative way have been developed. This study analysed the KPIs at «Cities Level» for smart city concept by using meta-analysis technique and literature reviewed that has been issued in three best reputable urban journals from 2017 through 2020. Environment, economy, governance and data management were found to have domain themes, as well as efficient and integrated urban management, environmental monitoring and management, public and social services in urban development and sustainability, are found to be the highest important dimensions of urban and regional planning. In addition to these, smart tourism, smart healthcare, smart people, smart transportation as well as the dimensions of cultural development, innovation, creativity and entrepreneurship are also open to development. This detailed study presents a crucial understanding of the key basic research topics/themes in smart cities, emphasizing the restrictions of the latest improvements and potential further aspects. The results of this research might be used in SIMURG_CITIES to assess/evaluate urban development models by related target groups such as smart city policymakers/planners/developers to prefer the best appropriate tools for their requirements, can be used as a foundation for performing future crucial analyses of

assessment/evaluation framework, may also lead the performance-based development and assessment of sustainable and sophisticated solutions in the future.

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Conflict of interests
The authors declare no conflict of interest.

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Urban Land-use and Traffic Congestion: Mapping the Interaction

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ABSTRACT

The interaction between transport, land-uses and travel patterns produce diverse transportation problems in urban cities with traffic congestion as the most visible manifestation. Traffic congestion is a frequent phenomenon in most cities around the globe. This paper reviews the interaction between land-use traffic congestion through published literature. The objective of this study is to encourage and provide researchers with future research directions in land-use and traffic congestion. For this purpose, a systematic review was performed analysing 45 articles from the year 2010 to 2020 using a descriptive approach. Subsequently, the results of the study show that although the interaction between land-use and traffic congestion has gained currency in developed countries far less is known on this subject in developing parts of the world, though new evidence is steadily accumulating. Consequently, limitations of this work are presented, opportunities are identified for future lines of research. Finally, the conclusion confirms the need for further research addressing the methodological concerns.

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1. Introduction

This systematic review aims to examine the recent literature on the interaction between land-use and traffic congestion. Traffic congestion has become a ubiquitous problem worthy of policy attention and citizens alike (Shahgholian & Gharavian, 2018; Uniyal & Gandhi, 2019). The rush hour has become a two or three-hour peak period, and congestion recurs mornings, midday, midevening, and on weekends as well (Jayasooriya & Bandara, 2017). Mir Shabbar, Muhammad, and Syed Fazal Abbas (2014) argue that unplanned land-use results in traffic congestion. Other scholars have asserted a connection between land use and traffic congestion in urban areas (Colonna, Berloco, & Circella, 2012; Kuzmyak, 2012;

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Mukherjee, et al., 2014; Zhang, et al., 2017). However, the magnitude and significance of a relationship between land use and congestion remain unclear. Two major impediments to statistically sound, comparative studies of land use and congestion exist a lack of good measures of congestion; and the difficulty in modelling the complex interrelationships between congestion, land use, and transport infrastructure (Wang, 2010).

Traffic congestion is a comparison of the use of transportation systems with the capacity of the transportation system. In a way, land-use affects traffic congestion in both dimensions. On the supply side, the street network determines the number of lane-miles in a given area whereas, on the demand side, different types of land-uses will cause variation in travel behaviour (such as travel frequency, length and mode choice) which in turn influences the level of congestion (Ewing & Cervero, 2017). A sizeable number of studies have investigated the impact of density development (compact or sprawl) on vehicle-miles traveled (VMT), traffic volume (e.g. annual total traffic volume, and volume to capacity ratio), throughput (e.g. vehicles per hour, and average daily traffic per lane), travel time and speed, travel delay, and congestion indices (e.g. travel time index and roadway congestion index) (Cervero, 2013; Engelfriet, 2015; Ewing, et al., 2014; Ewing, et al., 2018). However, these studies have reported mixed links between density and traffic congestion measures.

In response to the new urbanism and compact city concepts, developments with diverse uses are strongly thought to maintain sustainability and reduce car dependency (Kusumastuti & Nicholson, 2017). There is relatively strong and significant empirical evidence that diversity reduces the individual VMT (Cervero, 2013; Geyer & Quin, 2019; Spears, Houston, & Boarnet, 2013). A balance between jobs and housing might reduce the length of commute trips thus reducing traffic congestion and air pollution. Scholars have been arguing that the reasons for the continued lengthening of commuting times and the marked deterioration of traffic conditions are the results of the increasing job and housing imbalance in many metropolitan areas (Niedzielski, O'Kelly, & Boschmann, 2015; Zhang et al., 2017). A community is considered balanced when residential and employment distributions are approximately equal (Jiangping, Chun, Xiaojian, Wei, & Peng, 2014; Masoumi et al., 2018; J. Zhou & Long, 2014).

Areas with diverse uses are found to significantly increase slow modes shares, increase walk mode choice for work trips (Ton, et al., 2019) and non-work trips (W. Zhou & Li, 2016). The proximity of commercial centers to the residence location has a strong impact on increasing the walk mode share for non-work trips (Alqhatani, Setunge, & Mirodpour, 2014). Regarding public transport (transit), similarly, empirical evidence is found in the literature about the positive impact of the land-use mixture in promoting the frequency and mode share of public transport. Numerous scholarly efforts have observed that walking distance and walking time are critical factors in determining mode choice (for example whether to use public transport or not) (Durand et al., 2016; Ewing & Cervero, 2010; Grisé, Wasfi, Ross, & El-Geneidy, 2019). A plethora of studies has investigated whether urban design increase or reduce traffic congestion (Ewing & Cervero, 2010). Household VMT could be significantly reduced with an increase in bicycle lane density or with an increase in intersection density (Litman, 2012). In contrast, residential areas with a high proportion of intersections are empirically found to provide pedestrian-friendly land-uses. These areas significantly increase the active transport trip frequency and increase the probability of the walk mode choice for work and other trips alike

Another body of research investigated the impact of destination accessibility on traffic congestion (Ewing & Cervero, 2010; Hasibuan, et al., 2014; Suzuki, et al., 2013). A development toward a more sustainable transport system (as in increasing walking, cycling and public transport, and decreasing car-use) has been regarded as an important aim in the field of transportation research in the last decades due to an array of reasons, including environmental issues and congestion. Therefore, the objective of this literature review is to present current issues surrounding the interaction between land-use and traffic congestion. For this purpose, a systematic literature review published from 2010 to 2020 is carried out. A systematic literature review was chosen due to its transparent and replicable characteristics, and its identification of research gaps and occurrence for further investigation. This review analyses the literature from a descriptive standpoint, to assess advancement and emphasize the areas of further research required. Thus, this study aims to answer the question: what sort of a relationship

exists between land-use and traffic congestion? For this purpose, the present review is organized as follows: Section 2 presents the methodology followed by Section 3 which presents the results of the investigation. Section 4 presents the discussion of the topic, section 5 presents the research gap, section 6 presents limitations and future research and finally, Section 7 presents a brief conclusion.

2. Methodology

To provide a vigorous review of the literature we performed a systematic review on the relationship between land-use and traffic congestion. The inclusion criteria were (i) publications indexed in Elsevier, ScienceDirect and JSTOR databases, (ii) publication date between 2010 and 2020 (iii) written in English, and (iv) particular search terms covered. Editorial material, books, or book chapters, technical reviews were excluded from our research. We employed the Systematic Review Data Repository (SRDR), a cutting-edge tool for extraction, administration and inspection of data for our systematic review. Gathering and analysing publicly accessible literature we required no institutional ethics approval before initiating our research. During the period August 2019 we conducted a quantitative literature review of Elsevier, ScienceDirect, and JSTOR databases, with search terms including "land-use" and "traffic congestion" Out of 436 papers found, dated from 2010 to 2020, only 45 articles met the eligibility criteria. These articles were analysed and classified according to different categories based on their characteristics. Descriptive analysis was adopted and it included the geographical framework and research methodologies being used. Fig 1 depicts the sequence of steps undertaken for this research methodology.

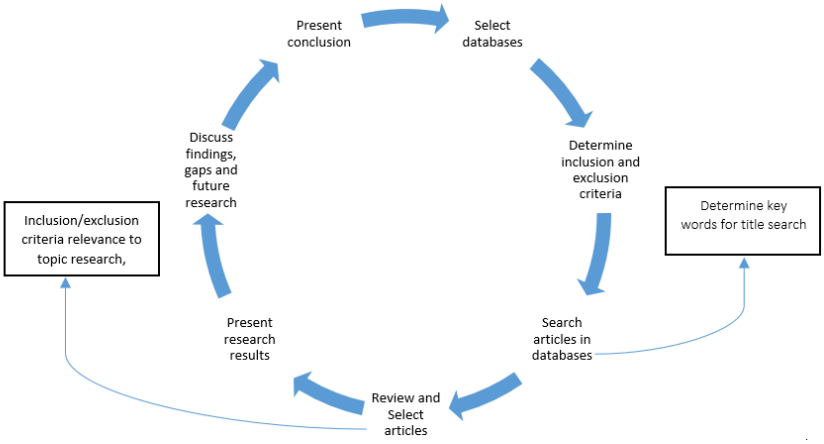

Figure 1. The sequence of steps taken for this research methodology.

3. Results

The results comprise of descriptive analysis of the 45 articles. The descriptive analysis consists in identifying and classifying the articles by geographical framework and analysis of research methodology.

3.1 Analysis of articles by the geographical framework

Table 1 shows the geographical framework of articles used to analyse the interaction of land-use and traffic congestion.

Table 1. Distribution of articles by the geographical framework.

Geographical Framework	*Total*
Africa	*1*
America	*20*
Asia	*11*
Australia	*4*
Europe	*9*

The geographical distribution shows that the American continent dominates research on land-use and traffic congestion. For instance, Wang (2010) used a multi-dimensional approach to measure the impact of land-use and traffic congestion in Florida. Kuzmyak (2012) performed a detailed analysis of the relationships between higher-density land-use and traffic conditions in four Phoenix transportation corridors in the United States. Using aggregated commute data from the American Community Survey, Gordon and Lee found that job dispersion, rather than just density or population dispersion is the critical factor for congestion and travel time. Ewing, Keith, et al. (2018) conducted a study in the United States and found that compact, mixed-use development is inherently more efficient and sustainable, using less land and reducing

private vehicle use rates by bringing people and activities closer together, and also providing densities that are capable of supporting walking and effective transit services. Adetunji (2020) stated that as population increase, the number of automobiles, tricycles, and motorcycle also increase.

Some notable studies conducted in Asia include a study conducted by Patel, Kheni, Patel, Patel, and Chauhan (2019) who evaluated traffic congestion using a comparative land-use pattern in Surat, India, and found that land-use impacts the movement of traffic. Zhang et al. (2017) proposed a new method to describe, compare, and classify the traffic congestion points in Beijing, China, using the online map data and further revealed the relationship between traffic congestion and land-use. Shubho and Neema observed that careless unplanned development of land-uses in Dhaka, Bangladesh has resulted in perpetual traffic congestion along with pollution, thereby aggravating its sustainability. Mukherjee et al. (2014) carried a study to determine the effects of heterogeneity in land-use distribution on traffic congestion in rapidly urbanising Ranchi City, capital of Jharkhand state, India and found that there is a positive relationship between heterogeneity in land-use distribution and traffic congestion. There is a paucity of studies on the research topic in the African continent. The only study obtained from the search was a study by Oduwaye, Alade, and Adekunle (2011) who surveyed the land-use and pattern along the Lagos-Badagry corridor, in the Lagos metropolis, Nigeria.

3.2 Analysis of Research Methodologies

This sub-section presents a comprehensive analysis of the methodologies that were used to uncover the relationship between land-use and traffic congestion. Although a consensus has been reached on the interaction of land-use and traffic congestion, the magnitude and significance of a relationship between the two are still unclear suggesting that there might be inconsistencies in the methods used to analyse this topic. The differences in conceptual models in previous studies are likely to generate contradictory results. For instance, land-use is measured in different ways (Newman & Kenworthy, 2015) and so is congestion (Rao & Rao, 2012). Ewing, et al., (2018) assert that no one has yet determined, using credible land-use metrics and credible congestion data, the net effect of those countervailing forces on area-wide congestion. Cutsinger et al., (2010) points that there are eight dimensions of the metropolitan structure, namely: density, continuity, concentration, clustering, centrality, nuclearity, mixed uses, and proximity.

Ewing et al. (2014) used the compactness/sprawl index metrics methodology to measure sprawl in 162 U.S urbanised areas. Following the same logic, Sarzynski, Galster, and Stack (2014) explored the multi-dimensional variations and changes in U.S. metropolitan land-use patterns during the 1990s. Jaeger and Schwick (2014) have conducted analyses extending the time considerably. They developed a Weighted Urban Proliferation (WUP) metric to assess urban sprawl in Switzerland and present for the first time quantitative figures about the development of sprawl for an entire country over a time of more than a century. Their method is suitable for studying changes in regional sprawl patterns over time and offers valuable tools for analysing the changing nature of sprawl and urban development historically. European Environmental Agency used urban permeation (UP) and WUP as sprawl metrics for all European countries. Fuladlu (2019) that urban sprawl does not promote auto-dependency.

Cutsinger et al., (2010) used a multidimensional conceptualization of land-use to prove to be an important improvement. Cervero (2013) conducted a cross-sectional study design with Structural Equation Modelling (SEM). Using compactness/sprawl metrics they found that an increase in compactness reduces the amount of driving people to do, but also concentrates the driving in smaller areas. Using data from 45 county-level urban areas of 2007 in the State of Florida, Wang (2010) measured 12 indices of land-use and 3 measures of traffic congestion, grouping them into 5 distinct factors and conducting bivariate analysis between variables. Kuzmyak (2012) used the volume to capacity ratio (V/C ratio) to measure congestion and density, diversity, and destinations to measure land-use.

In light of the articles reviewed, it clear that there is a lack of consensus on the credible variables, congestion data used, population size, and consideration for reverse causation and time-lags. This lack of consensus suggests

that further refinement of the models may be necessary, paying special attention to these methodological issues.

4. Discussions

This study conducts a literature review of articles on land-use and traffic congestion, published from 2010 to 2020, in Elsevier, ScienceDirect, and JSTOR databases. This research investigates the available literature under several constraints: Time period, English language, three database sources, research and literature articles only with different variants on search keywords, and land-use and traffic congestion emphasis. Furthermore, this research classifies the extracted articles under different approaches: Distribution of articles by the geographical framework and research methodology, and tools and techniques used for analysis. The results of these classifications have facilitated the discussion on the current status and progress on traffic congestion and land-use. Therefore, the key findings will be discussed, followed by the research gaps and future research opportunities.

Policymakers, including transport planners and transport engineers, have become increasingly aware and interested in understanding the interaction between land-use and traffic congestion. However, there is a paucity of research on the research topic in developing countries. Out of 45 articles used for this study, the American continent had 44%, followed by Asia (26%), Europe (21%), and Australia (8%) whereas African had less than 1% of the articles. The study also revealed that the United States has been the major contributor to land-use and traffic congestion articles, followed by China, Bangladesh, Europe, and Nigeria. The study revealed that linear regression is the most used technique (21 articles) followed by correlation analysis (17 articles) and the least used approach is Structural Equation Modelling (SEM) (7 articles), Ewing, Tian, and Lyons (2017) used a cross-sectional study, regression analysis along with Structural Equation Modelling. Kuzmyak (2012) developed a set of regression models to quantify the effects of key land-use variables on household vehicle ownership and VMT, illustrating the mitigating effects of higher density, better mix, and better transit accessibility.

Density is the most commonly used measure of land-use. From the articles used, 87% used density, design, and diversity concerning traffic congestion. Wang (2010) adapted the multi-dimensional approach to measure land-use and traffic congestion. He obtained data obtained from 45 county-level urban areas as of 2007 in the State of Florida. In the conceptual model, he developed three (3) congestion indicators – Roadway Capacity Index (RCI), Travel Time Index, and delay per capita, which were correlated with twelve (12) land-use measures, grouping urban form indices into 5 distinct factors, and conducting bivariate analyses between variables. Zhang et al. (2017) used linear regression analysis to determine the influence of the high proportion of commercial land-use on traffic congestion. The findings show that there are studies on land-use and traffic congestion in developing countries particularly in Africa are scarce. Furthermore, the study findings show that there are inconsistencies in the methods that were used to analyze the topic.

5. The Research Gaps

The current body of knowledge lacks empirical insights into the interaction between land-use and traffic congestion in developing countries. There has been inadequate attention to and discussion on how land-use influences traffic congestion in developing countries. However, a great amount of literature-based evidence on the research topic is abundant in developed countries but findings from these studies have been refuted based on methodological concerns. For instance, a sizeable number of scholars have focused on how density influences traffic congestion but the influence of other measures of land-use (such as diversity, design, destination accessibility, and distance to transit) on traffic congestion is scarce. Besides, previous studies have used basic measures of traffic congestion and obtained varying results. For example, Kuzmyak (2012) used volume capacity (V/C ratio) and found that that there was considerably less congestion despite densities that were many times higher in four Phoenix transportation corridors in the United States of America while Zhang et al. (2017) used commute time and found that a reasonable ratio of land-use could efficiently reduce traffic congestion. However, studies exploring the interaction between land-use and traffic congestion using a multi-dimensional approach are limited. Therefore, it is important to address the deficiencies exhibited by basic

measures through the use of a multi-dimensional approach.

6. Limitations and Future Research

This sections present limitations and further research opportunities. The restriction of database access availability has limited the research and thus articles from other sources of primary importance on the interaction between land-use and traffic congestion could have been excluded from processing. The keywords used may not be all-inclusive. The review was carried out on 45 articles; therefore, the exploration of more articles could broaden the conceptualization and knowledge of empirical research, and issues currently addressed regarding land-use and traffic congestion. The land-use dimensions that influence traffic congestion have not been studied in the same magnitude particularly in developing countries. Besides, a plethora of research has not yet agreed on the proper methodology to use when examining the interaction between the two. Likewise, the current body of literature on the research topic can be criticised for a lack of insight into the aspects that make a good congestion measure. For example, commute time computes travel time across different travel modes; ADT/lane and commute time are averaged numbers across time and space while delay per capita is limited to peak hours and only for arterial and freeways. Therefore, research on the interaction between land-use and traffic congestion must evolve from these basic indicators and use multi-dimensional measures. Moreover, by increasing the number of articles, more specific topics can be analysed and trends can be identified with greater precision. Furthermore, there is a need to segregate empirical research for developed and developing countries due to intrinsic differences that may result in distinctive findings.

7. Conclusions

Research on the interaction between land-use and traffic congestion in developing economies has begun and advanced in the last two decades, however it is still in its infancy when compared to research in developed countries. This study attempted to enrich the knowledge of the research field by carrying out a literature review of articles available on specific databases in the last decade. The undertaken different approaches classification and analysis of the selected papers helped to provide and discuss outcomes on current research status. Although a consensus has been reached on the interaction of land-use and traffic congestion, the magnitude and significance of a relationship between the two are still unclear thus a critical knowledge gap that needs to be filled. The ongoing debate with regards to the significance of the relationship is intensified by inconsistencies in methodological approaches, lack of multi-dimensional measures for both land-use and traffic congestion. Further research can be directed toward addressing these issues. It is also recommended to conduct a study on the topic in developing countries as far less is known on this subject.

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Conflict of interests

The authors declare no conflict of interest.

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Book Review: Smart City Citizenship

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Algorithmic nations.

ABSTRACT

Against the backdrop of the current hyperconnected and highly virialised post-COVID-19 societies, we, 'pandemic citizens', wherever we are located now, have already become tiny chips inside an algorithmic giant system that nobody understands. Furthermore, over the last decade, the increasing propagation of sensors and data collections machines and data collections machines in the so-called Smart Cities by both the public and the private sector has created democratic challenges around AI, surveillance capitalism, and protecting citizens' digital rights to privacy and ownership. Consequently, the demise of democracy is clearly already one of the biggest policy challenges of our time, and the undermining of citizens' digital rights is part of this issue, particularly when many 'pandemic citizens' will likely be unemployed during the COVID-19 crisis. This book suggests reverting the intertwined mainstream paradigm of the technocratic policy scheme popularised as Smart City. The Smart City paradigm has increasingly been influenced (and even shifted) by the debate regarding urban liberties, digital rights, and cybercontrol by leading us to the consideration that actually the Smart City incarnates a society of techno-political control, which in itself has flourished abundant critique from cybernetic urbanism. To provide a constructive standpoint and acknowledging that since 2018 GDPR may have well contributed to open up a pertinent debate, this book asks whether it is possible to alter existing data governance extractivist models to incentivize further democratic citizenship through data ownership and technological sovereignty. As such, the book highlights citizen's perspective and social accountability in both transitional and experimental frameworks by pointing out the importance of creating platform-based alternative urbanism such as data and platform co-operatives. To examine citizenship is always important but perhaps never more urgent than right now in the fragile post-COVID-19 hyperconnected societies. Amidst the AI-driven algorithmic disruption and surveillance capitalism, this book sheds light on the way citizens take control of the Smart City, and not vice-versa, by revolving around the new book entitled Smart City Citizenship recently published by Elsevier. By following the methodological and conceptual proposal of the book, this review article will introduce nine key ideas including how to (1) deconstruct, (2) unplug, (3) decipher, (4) democratise, (5) replicate, (6) devolve, (7) commonise, (8) protect, and (9) reset Smart City Citizenship.

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1. Introduction

Citizens in Europe have likely been pervasively surveilled during and probably as a result of the COVID-19 crisis (Aho & Duffield, 2020; Hintz, Dencik, & Wahl-Jorgensen, 2017; Kitchin, 2020;

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Zuboff, 2019). Despite the fact that the homologation of the vaccine has sped up, its equitable distribution globally cannot be ensured yet. As such, the coronavirus does not discriminate and affects citizens translocally, yet it has unevenly distributed economic and social impacts across and within state borders, producing a new pandemic citizenship regime that exposes health, socio-economic, cognitive, and even digital vulnerabilities. But how can e-democracy be ensured for all citizens while also creating further democratic citizenship to avert the algorithmic and *data-opolitic* (Hand, 2020; Stucke & Grunes, 2017) extractivist hegemonic paradigm as well as Orwellian cybercontrol through massive contact-tracing apps that serve as a digital panopticon of the Leviathan (Kostka, 2019)? To examine new emerging citizenship regimes is always important but perhaps never more urgent than right now in fragile post-COVID-19 hyperconnected societies. COVID-19 has hit European citizens dramatically, not only creating a general risk-driven environment encompassing a wide array of economic vulnerabilities but also exposing them to pervasive digital risks, such as biosurveillance, misinformation, and e-democracy algorithmic threats. Over the course of the pandemic, a debate has emerged about the appropriate techno-political response when governments use disease surveillance technologies to tackle the spread of COVID-19, pointing out the dichotomy between state-Leviathan cybercontrol and civil liberties, and further requesting in-depth debates. Moreover, the giant technological flagship firms of surveillance capitalism, such as Google, Amazon, and Facebook, have already assumed many functions previously associated with the nation-state, from cartography to the disease surveillance of citizens. But particularly, amidst the AI-driven algorithmic disruption and surveillance capitalism, this book sheds light on the way citizens could take control of the *Smart City*, and not vice versa.

2. Summary

This book presents nine intertwined key ideas that show systemically a path to follow to further experiment using action research methodologies (not a recipe) as a techno-political route for smart citizen action from the social innovation perspective (Calzada, 2021) as follows:

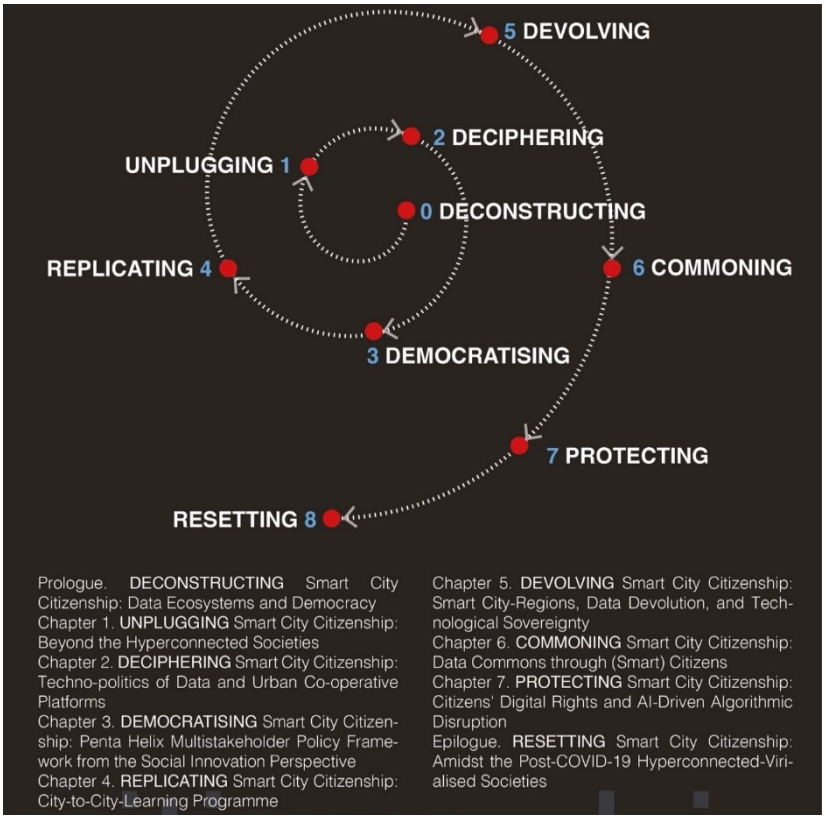

Figure 1. Smart City Citizenship as a spiral consisting of 9 intertwined key ideas from the Social Innovation perspective.

The demise of democracy is already one of the biggest policy challenges of our time that urgently requires deconstructing the aftermath of the extractivist models' negative externalities affecting pandemic citizens. Debating on the techno-politics of data for citizens cannot be seen as an operation of ethic washing; it should be about ownership and how to rescue democracy. Failing to do so could risk exposing democracies to the stealthy algorithmic manipulation of collective behaviours through social media, resulting in a dystopian populism.

Consequently, in the post-COVID-19 societies, unplugging or being offline is a nearly unaffordable privilege that very few dares to attempt. Potentially the opportunity to be offline has been rarely considered to be valuable so far. After the increasing enthusiasm for using data to improve the life of citizens in modern societies, the publication of a considerable amount of confidential information of citizens and heads of states via espionage, surveillance, dataveillance, and theft has somewhat altered the data enthusiasm of some communities (Lupton & Michael, 2017; van Dijck, 2014). An increasing number of voices note benefits to not being online constantly, thus challenging the widely spread techno-enthusiasm of the knowledge society. Hence, unplugging in the book is defined as a corrective from the corporate, top-down direction of the *Smart City* mainstream in favour of a transition towards the critical use of digital technologies enabling the construction of more democratic citizenship.

Therefore, deciphering the *Smart City* mainstream approaches requires a distinction between the hegemonic techno-centric *Smart City* approach and the new ongoing alternative intervention approach called an experimental city, a deep transition that aims to blend the interdependencies between various stakeholders to better re-align power relations and outcomes. It goes without saying that *Smart City* policy implementations not only have reduced the interdependencies among stakeholders to technocratic public-private-partnership (PPP) models but also have failed to question the identities of strategic stakeholders and how they uniquely prioritise their business and social models. Thus, three main questions are addressed in this book: (i) What prospects have existed so far for alternative funding and business/social models for cities? (ii) What practical/political interventions have been tried among stakeholders? (iii) To sum up, is another type of (smart) city possible? That is, is there a 'third way' between the state and the market that overcomes the PPP framework?

Smart City policy implementations not only have reduced the interdependencies among stakeholders to technocratic Public-Private-Partnership (PPP) models but also have failed to question the identities of strategic stakeholders and how they uniquely prioritise their business/social models. Beyond these PPP models, little has been questioned about the strategic stakeholders who have been formulating the *Smart City* priorities. As a result, the book suggests democratising the *Smart City* by rethinking multistakeholder helix strategies by ensuring the complete democratic representation of diverse voices from each helix. Particularly, it proposes explicitly moving from the Triple and Quadruple Helix models towards Penta Helix, where social entrepreneurs, activists, bricoleurs, brokers, and assemblers play an important role as transformative intermediators resulting in a wide range of business and social models (Direct public Provision, PPP, Public-Private-Academic partnership, Public-Private-Academic-People partnership, by reaching out Urban/Data Commons as the highest degree of experimentation.

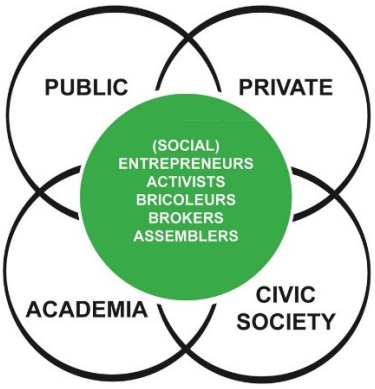

Figure 2. Penta Helix Multistakeholder Social Innovation Framework.

According to the urban scholar, Ayona Datta, the urban is not science. It cannot be replicated like other sciences. Surprisingly though, over the last five years, probably not only in the EC-H2020-SCC policy framework but also in other policy schemes in the Global North, replicating business models and projects

have been defined as 'the possibility of transporting or copying results from a pilot case to other geographical areas'. As such, replication was defined by policymakers as unidirectional, hierarchical, mechanistic, solutionist, and technocratic process among cities and their stakeholders. Strikingly though, over the last years, even several reports by the European Commission have acknowledged that replication is like the quest for the Holy Grail: everyone is searching but no one seems to be able to find it. Thus, and probably even clearer, in the aftermath of COVID-19 and because of the local implementations of the GDPR, the book argues that replication may not be happening among smart cities as it was anticipated. Hence, the fifth intertwined key idea refers to the given policy understanding of replicating urban solutions from city to city. The book suggests reverting the mechanistic and solutionist approach by adopting a mutual learning rationale among cities by establishing the City-to-City-Learning Programme being defined as multidirectional, radial, dynamic, iterative, and democratic. As the conclusion of replication, fieldwork research conducted in Nilüfer (Bursa province in Turkey), Essen (in Rurh, Germany), and Lausanne (Switzerland) reveals that there is significant room for manoeuvre for local stakeholders in their ability to pick and choose, adapt, and prototype between innumerable intervention models and networks (Calzada, 2020a).

The six intertwined key idea focuses on the institutional and techno-political configuration of different city-regions devolving data to citizens. Insofar as data are contextual (Loukissas, 2019), this chapter examines how four city-regions (two in the UK, Glasgow and Bristol and two in Spain, Barcelona and Bilbao) dealt with data governance models. In the post-GDPR context, citizens' data security and ownership ultimately need to be protected by localising personal data via grassroots innovation and platforms and data co-operatives. Data, being a public good, should be devolved and brought back to citizens, meaning that Data Devolution schemes through multi-level governance models should be implemented onwards. Considering how relevant the city-regional path-dependency is in each territorial context, and analysing in-depth four case studies, two in the UK, Glasgow and Bristol and two in Spain, Barcelona and Bilbao: fieldwork research found that the notion of Data Devolution is a key governance component for data ecosystems in Europe that is enabling some cities and regions to formulate their own smart governance policies (Scottish Government, 2021). After conducting fieldwork research in the four city-regions, the book identifies an implicit Smart city-regional governance strategy for each case study: Whereas in Spain, Bilbao could be seen implementing a Corporate-in-Transition strategy and Barcelona has been pushing ahead an Anti-Corporate but highly uncertain strategy; in the UK, Bristol attempted to implement a strategy based on an alternative open innovation model embodied by Bristol is Open umbrella and Glasgow has been moving from a conventional governance model towards its current claim on digital rights by being an effective part of the Cities Coalition for Digital Rights (CCDR; led by Barcelona; Calzada & Almirall, 2020).

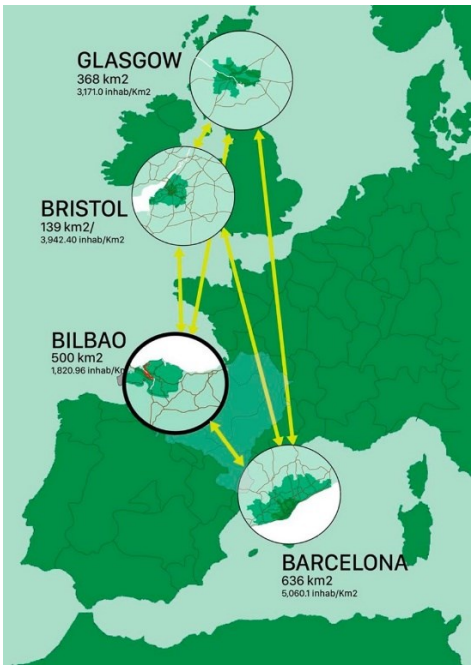

Figure 3. Data Devolution and Multi-Level Goverance Models in four case studies: Glasgow and Bristol (UK) + Barcelona and Bilbao (Spain)

The seventh intertwined key idea demonstrates that unpacking the ownership of data and its governance structures and dynamics within their citizenries is as important as the collection, storage, and usage of data in AI-driven cities. As one of the core cases studies of the book, Barcelona leads this way by formulating policies that consider citizens decision-makers rather than data provides by commoning their data. It is rather evident that the availability of

data is and will be part of the new conditions in cities. Yet, unpacking the ownership of data and its governance structure and dynamics within their citizenries will be as important as the collection, storage, and usage of data in AI-driven cities. The future will probably show an increasing number of city-regions rolling out unique Smart City-regional strategies. As a result of the ongoing fieldwork research on the case of Barcelona, findings revealed that the main digital policy framework coined by Barcelona was Data Commons including DECODE, DECIDIM, and METADECIDIM, among other initiatives related to Digital Social Innovation, Urban Commons, and Social Economy. Nonetheless, the book leaves one open question to be responded by further future research: To what extent Barcelona's ongoing strategy is little more than a declaration of intentions of a progressivist *Smart City* policy agenda? It remains to be seen. How could citizens decide, control, govern, manage, and ultimately, own their own data by being both conscious of digital rights to the city and aware of duties in the techno-political processes of city-making?

As a result of this, we reach the eight intertwined key idea: Protecting. This chapter argues that there is a need to establish pan-European Data Infrastructures and Data Institutions (collectively as Data Ecosystems) to protect citizens' digital rights in Europe. AI-driven algorithmic phenomenon has led to new consequences (such as hyper-targeting through data analytics, facial recognition, and individual profiling). This resulted in not-so-desirable outcomes, such as massive manipulation in the US and the Social Credit Systems in China. In contrast, these societal concerns raised a debate in Europe about digital rights and AI-driven algorithmic disruption by spurring a call to action (Dyer-Witheford, Kjosen, & Steinhoff, 2019).

Ultimately, the book ends up with Resetting. So far, the urban phenomenon and its sociotechnical controversies have been explicitly surfacing until we have reached this unknown and highly unexpected status of 'the new normal'. We all, Pandemic Citizens (Calzada, 2020b; Craglia et al., 2021), sharing similar fears, uncertainties, and risks, are exposed differently depending on which country we call home and our related living conditions. Actually, this pandemic crisis has been gradually and pervasively fuelling data governance issues, which exposes pandemic citizens' vulnerabilities.

Alongside this general threat, several questions arise: (i) Should governments protect citizens from being infected even if this might mean establishing a new digital non-privacy norm? (ii) Will this pandemic crisis become an algorithmic crisis, with serious side effects for governments worldwide? (iii) How can citizens organise themselves to establish new social capital that could overcome the post-COVID-19's social distancing measures? (iv) Could digital co-operatives (either platform or data coops) be the answer? (v) To what extent is possible to think in these terms seeing an increasing degree of individualism and selfishness caused by the pandemic fear and the general sense of uncertainty? (vi) Are we able to reset our cities and communities from the Foundational Economy perspective by putting in the centre what matters with the inevitable obligation to do the right thing after this reset (2020)? Against the odds, pandemic citizens are beginning to develop new ways to responding to the COVID-19, through mutualising and donating data using data altruism/donation, including the creation of platform and data co-operatives (Scholz, O'Brien, & Spicer, 2021). Nonetheless, the book leaves one pending and open point for further research: It remains to be seen whether platform-based alternative urbanism such as platform and data co-operatives (among other data governance models) could very much revert extractivist data governance models by establishing a feasible and sustainable pathway onwards to foster further democratic citizenship (Bigo, Isin, & Ruppert, 2019). What is clear is that we must sharply hit the nail on the head, in this, final occasion. RESET.

3. Analysis

Methodologically speaking, in the book, Critical or Radical Social Innovation could be seen as the approach from where to conduct action research interventions to democratise smart cities through citizenship (Moulaert & MacCallum, 2019; Nguyen, 2017). Social Innovation in the book is defined as the capacity to elaborate alternative discourses and actions that are counter-hegemonic in terms of resistance and/or innovative transformations.

As such, the book is clearly analysing the following questions: (i) How can digital technologies transform the relationships between governments, business, and civil society? (ii) Which techno-political (power) relations and dynamics exist between these agents, and how do they change? (iii) Which roles do innovative applications of digital technologies and the use of newly emerging technologies play in the post COVID-19 society? (iv) How do helix frameworks intersect with contact tracing and tracking apps? (v) What role do the public authorities and civic bottom-up initiatives play in addressing the power imbalances of the current data-driven smart cities' landscape (between data providers, data platforms, and ultimately, decision makers)? Critical or Radical Social Innovation may provide the lenses to better steer changing power-relationships among stakeholders.

4. Conclusion

COVID-19 has been a trigger for increasing the impact of digital transformations on the daily lives of citizens. However, little is known or has been explored in relation to the direct effects of *Big Tech* surveillance capitalism and the cybercontrol push by nation-state governments during this crisis on pandemic citizens. The book contribution could be summarised as follows:

(i) It highlights citizen's perspective and social accountability in both transitional and experimental frameworks for reorienting smart cities by pointing out the importance of creating platform-based alternative urbanism such as data and platform co-operatives.

(ii) In doing so, the book encourages further future interdisciplinary research agendas anchored in social sciences on the present and future techno-political challenges of citizenship in data-driven smart cities by reclaiming the original sense of sustainable peer-to-peer exchanges.

(iii) Another conclusion that it could be drawn on the book is the fact that citizens can be effectively empowered in the emerging post-GDPR realm, creating more inclusive digital citizenship.

(iv) In addition to this, probably we still may need to absorb the new techno-political awareness of the 'new normality' for democratic urban decision-making paying special attention to AI disruption and citizens' digital rights in the post-COVID-19 hyperconnected and highly virialized societies.

(v) Ultimately, the book leaves an open question to the reader for being answered: It remains to be seen whether platform-based alternative urbanism such as platform and data co-operatives could very much revert extractivist data governance models by establishing a feasible and sustainable pathway onwards.

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Conflict of interests

The author declares no conflict of interest.

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Original scientific paper

Towards the Egyptian Charter for Conservation of Cultural Heritages

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ABSTRACT

The notion of "Cultural heritage" is quite modern compared to other humanistic fields developed in the last century. Conservation as a science has emerged and took shape during international conventions and treaties in many places in Europe and developed various frameworks to recognize the heritage and its value but based on "Eurocentric bias" criteria. The fact of sharing universal values and common practices during the age of globalization had a significant impact on conservation actions in contexts utterly different from western societies and don't share the same historical or cultural dimensions. Therefore, this study traces the history of the evolution of conservation in the west from two perspectives; the historical one and the developing methodologies, and the philosophies behind the main theories in conservation. Cultural heritage is a reflection of the identity of the society and its past; thus, this study outlines the development of conservation practices in Egypt within the international approaches in a chronological order to investigate the social response and the impact of the political and cultural influence of the cultural consciousness of the society and the conservation actions in the Egyptian context. Furthermore, to investigate the contribution of international charters in developing national policies in Egypt.

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1. Introduction

The last century has witnessed a crucial development in the science of conservation and its theories. Most of the synthesis of the critical debates and critique was driven by western intellectuals and historians who perceived the past from their perspective (Yazdani Mehr, 2019). Moreover, developed protection methodologies and techniques that are compatible with the legacy of their ancestors. All these efforts paved the way to have a profound base for conservation as science and expand its definition to include cultural heritage as tangible and intangible heritage (Laurajane Smith & Akagawa, 2008).

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However, these efforts reached a point at which we cannot move forward unless we look back at the origins of that science and review them analytically (Cuno, 2010). To perceive the past of a product of an individual nation, the principles of conservation and heritage recognition must be revised and adapted before being adopted blindly anywhere else. History is not just the told past, it's a cultural element that must be perceived within its context; through the remarks of the previous civilizations and the actions of the new ones.

The French Novelist Marguerite Yourcenar once declared that the changes caused by people's tastes are more profound than those caused by time. By this statement, the art historian reflected on the subjectivity towards the protection of heritage or monuments with peculiar values for the society. Admiring the legacy of the ancestors could be something inherited in the culture, not imposed or shaped by the importance of the monument itself, not its historic and aesthetic values (Szmelter, 2013). Time changes the taste of people, the way they perceive and evaluate things and it changes buildings as well and leaves traces of the passing of time. This change of taste is the social consciousness of heritage that formed and refined over time from mere protection of the function to the preservation of buildings that recall a myth or holds a memory for the place, to a more advanced treatment based on scientific methodologies (Reid, 2002). The ever-expanding definition of the term conservation and its evolution from restoration and preservation was an important topic in the global debate, that kept changing after critical times and significant events (De la Torre, 2013). However, the global conflicts urged the need for conservation management in many places; some contexts showed contradicting reactions like Egypt. The most recent debate is going towards generating conservation strategies led by the society as the main player in identifying their values and assessing their monuments. In Egypt, where the long history is the accumulation of so many layers, each one of them left behind a legacy that must be recognized first then protected (Tunbridge, 1984). The review of several conservation actions in Egypt shows how society reacts to these movements. Although the concept of "cultural heritage" is drawn from humanities and made people question their heritage and evaluate their values differently, the development of this discipline in both theory and practice didn't flourish in Egypt compared to the international ones." (Rezk & Rabie, 2019). It is about time to start developing a national approach driven by the synthesis of international developments and social consciousness. The main aim of this paper is to highlight the milestones that shaped conservation as a science and its evolution concerning the critical political events and shifts in ideologies that affected its emergence directly. Moreover, in an attempt to fill the gap in recognizing the history of conservation in Egypt along with the international track; an analytical reading of each era and its historical consequences is provided as a research methodology; to clarify the sequence of conservation development and compare the Egyptian actions to parallel one in the international direction.

2. The nature of restoration in the past

The idea of building protection in the past was merely protection out of respected and valued structures, it was an expression of admiration and gratitude of the predecessors for centuries the process of protection aimed at deliberately erasing the traces of previous civilizations and alter their monuments in an action "to pursue in vain an attainable original condition" (Philippot, 1996). Some art historians claim that the regular maintenance of a building is considered as an act of conservation, however, the roots of conservation dates back to the Renaissance when the architectural stock began to be recognized by the society and the historians started to differentiate between the types of buildings values; eighter "art value" or "age value" (Marijnissen, 1996). Before the advent of the word "restoration" as a cultural concept, the slight improvement in cultural appreciation was the "Connoisseur", formulated by art historians who can contextualize and situate the artworks, and the archaeological artefacts in their original context and assess them by craftmanship. By the end of the 18th century, a more historical consciousness was established due to the industrial progression in western countries where the degradation of city centres became more prone to further deterioration after riots and several revolts. The industrial revolution put an end to the conventional ways of preserving the monuments and developed new ideologies.

2.1. Disconnection: traditional vs new ways of conservation

With the emergence of modernism, Europe has experienced a cultural paradigm, which formulated a new basis for restoration. There were two conflicting causes of the disconnection between the past as a "completed element" and the "modern European man"; The striving drift towards a modern scientific approach in restoration and architecture in general, on one hand, and the rift between the people and their past where, on the other hand, they could not pursue it as a continuous history. "*Purely scientific approach to the past cannot in itself to ensure the continuity that was guaranteed by tradition... to fill this gap another approach developed to keep the contact with the past in a nostalgic way which is "preservation." This rapture was due to the tension between the sense of romanticism of the past and the rationalism of the enlightenment*" (Philippot, 1996). the emergence of the stylistic approach was a milestone in treating monuments as reminiscent of a society.

The Father of the "stylistic approach"; Viollet-le-Duc, reformed the term "restoration" after the "Romanticism approach", and used elements according to the same form and appearance of the original building to complete it. Despite the speculative essence of this method that has been adopted and practised widely in many European contexts, it confronted a very critical disagreement from the intellectuals who opposed the concept of adoption and modification of public monuments, and the invention of "revival styles" as a synthesis of the historical findings and individual interpretations. (Yazdani Mehr, 2019). John Ruskin insisted on giving the builders credits and value each building, claiming that the workmanship and the intentions of the builders are something that cannot be re-established or rebirthed - "as impossible as to raise the dead" (Ruskin & Birch, 1885)- in an attempt to defend the "Authenticity" of the monuments. In the "Society for the protection of ancient monuments SPAB", he tried to set up standards for the idea of preservation following the "Anti-restoration" notion by replacing "restoration" with "protection" as daily care to halt decay.

By the end of the 19th century, Camillo Boito became a pioneer in Italian conservation who proposed his conservation guidelines in 1883 with new parameters of treatments and interventions and also established the first Italian charter in 1884. He developed a philological approach that harshly opposed the dualism between the "Revival restoration" and the "pure protection" as expressed clearly in one of his lectures "*with rare exceptions, only one wise course of action remains: to leave them alone or, where necessary to free them of restorations*" (Philippot, 1996). By this statement, Camillo declared the end of the "imitative restoration", and promoted his measures to restore and preserve a monument while keeping the historical appearance and value, therefore, he sorted our building by age. Moreover, he affirmed that by distinguishing between the layers of treatments and the original buildings, we can restore severely damaged monuments paved the way to introduce the notion of "anastylosis".

2.2. The age of universal values

Toward the outbreak of world war I that lasted for 4 years and followed by world war II after two decades; Europe had witnessed a devastating and destabilizing era. The main casualties of these two wars were the historical city centres and the national monuments. The destruction of districts and the displacement of thousands of people urged the governments to find new strategies to rebuild their cities as fast as possible with moderate costs. The modern theories at that time promoted the standardization of building codes and planning principles that can be implemented easily everywhere.

The motive of rebuilding their societies encourages the European communities to share a wide range of "universal values". Therefore, the fundamental ideas of the French revolution expanded and led to a movement of ignoring the traditional ways of building and organizing cities to be able to face the massive global (Rezk & Rabie, 2019). Concerning the restoration of monuments, it reached another peak by broadening the scope of interventions and take into consideration the restoration on a bigger scale including parts of the urban fabric (Lamprakos, 2014). Moreover, as a natural consequence, the society itself started to build cultural awareness.

Following a series of conventions and treaties, the broad definition of restoration and monuments started to be redefined and take a new shape within the social context. The

universal values revolved around the word "Heritage" and its cultural significance after being introduced in Athens Charter in 1931 (Khodeir et al., 2016). The contribution of this international participation helped in identifying the values of buildings and peculiar ones. Moreover, they acquired a special interest in reusing the destructed city centres instead of contentiously rely on passive conservation.
However, these efforts could not draw a proper framework and regulations for rehabilitation and integration of historical parts of the city with contemporary ones due to the various specialization in conservation after the 50s (Philippot, 1996). The modern and fast-growing tendencies developed the laboratory work and created an independent sector where intellectuals can have a prosperous debate that merges between scientific advancement and the humanities. the idea of "cultural conservation outreached other continents; each was trying to build their sensibility in dealing with heritage.

2.3. Urban conservation

In the following decade, historians discussed the notion of "urban conservation" based on the theoretical contribution of Cesare Brandi's writing and the "Teoria del Restaura" In1963; His theories were valid for almost 20 years in Italy till the constitution of "Carta del Restaura" in 1972. Some historians believe that Brandi's work can be conspired as a foundation for a conservation school, as the characteristics of conservation were not standard but kept reforming based on the term "Reversibility" (Barassi, 2009). Regardless of his great contribution, his theory was subjective, limited, and contradicts the variety of technological methods at that time Brandi treated the buildings and artworks from all contexts and eras equally, neglecting their historic and social value.

2.4. International Charters

The following international conferences in the 20th century were devoted separately to a specific topic, the most prevailing movement at that time was the relationship between the community as a driving force in developing the idea of "cultural heritage" and their monuments. After the establishment of ICOMOS, they paid attention to the policies on rehabilitation in general and "adaptive reuse" in specific. Venice charter in 1964 played a substantial role in shaping the content and focus of the international treaties by resolving the confusion between "conservation as a means of maintaining while the *restoration is a method to accentuate the aesthetic values*" (Yazdani Mehr, 2019) Such a global debate enhanced the idea of "Pluralism" of methodologies, where every context has a vast range of possibilities and choices in developing and regulating its approach towards their history.

2.5. The modern notion of the monument and the dilemma of value

In the 60s, the prevailing approach towards the realm of "Values" in conservation was influenced by the "historicism approach" which was imposed by Brandi and prioritized over the "Aesthetics values" of a monument (Rezk & Rabie, 2019). after almost two decades, the Venice charter had been revised and criticized by historians for endorsing the "historical" principles of determining "values" of the Athens charter and recasting them under the umbrella of "Universal values". Venice charter emphasized many unrelated articles regarding the authenticity of the monument and the principles of rehabilitation which caused and never-ending arbitrary explanation about the essence of "monument" (Lamprakos, 2014).
Alois Riegl, in 1903 developed his theory about the evaluation of monuments based on a set of values -instead of fixed values- that can shape the identity of the monument and can be investigated from the historical and the cultural dimension of the monument. his paper "the modern cult of the monument: it is charter and origin", can be considered as a profound base for studying the wide range of values and their attributes. The attributes reflect all the layers of the history of a monument, present, and future. He believed that the proper reading of the monument comes from the proper understanding of the integrated attitudes and how they identify the real values of a monument, therefore the proper conservation plan.

2.6. The development of Authenticity

The growing notion of preservation took a refined shape as a synthesis of conferences and conventions. A key twist in defining preservation science was Nara Document in 1994 (Szmelter, 2013). With the expansion of the definition of conservation, historians had to

face the struggle in determining the authenticity of monuments and context in the far east; in contexts that are entirely different from the European ones. The term itself had to be re-considered to be able to determine a framework to assess the authenticity of monuments that can extend to include the authenticity of the beliefs and notions.

2.7. The 20th century -Money ethics-

the 21st century is the acme of the holistic notion of "cultural heritage", It adopted and integrated both aspects of heritage; tangible and intangible manifested in language, customs, beliefs, and social norms. The focus on the notion of tangible heritage started recently after the year 2000, but it was discussed for the first time officially in the international debate in the "folklore and traditional culture" UNESCO recommendations in 1989.

The expanding definition of conservation influenced social awareness and heritage recognition especially during globalization and the era of mass tourism (Orbasli, 2002). Globalization altered the importance of heritage to be seen as a national income source from an economical point of view. Thus, new policies emerged to use heritage in generating income especially after the release of the world heritage list in 1972. The universal vision of heritage appeared again behind the so-called "international heritage" (Rössler, 2006). Compared to any other science, the science of conservation is considered as a very dangerous process that took shape rapidly in the last 60 years; a science that is evolved based on analytical theories, critiques, and debates on the empirical treatments and special cases with both shortcomings and virtues.

3. Conservation in Egypt

The old eastern civilization, particularly Egypt has developed a sensibility regarding their heritage recognition, but not as a "memory" out of admiration and appreciation, but as a "memory" that can be lived, experienced, and be expressed in everyday activities and lifestyle of various communities (Szmelter, 2013). The definition of restoration as the continuous care of buildings has always been practised in Egypt in all eras since the pharaohs. However, the scientific meaning of the conservation process has been introduced in Egypt at the end of the last century. The old civilizations in Egypt developed their methods of preserving their monuments as well as the larger context that has significant importance such as necropolises and temples to satisfy their "divine leadership" notion and to manifest the idea of "eternity". The authenticity of the intent of the builder is a profound role in preservation in Egypt; they aimed at making their monuments last till the afterlife.

The following epoch and the spread of Islam changed the beliefs and the ideologies of the society and the conception of preservation with new principles that conform to the principle of Islam. The new conception was described as "Eslah" which means "repair"; the regular repair of a public building that has a certain function in serving people and should be functioning for the benefit of the society. During the Mamluk era, a certain typology of public buildings called "Al-Waqf" flourished and was constructed all over the country. the efficiency of these buildings is strictly related to "Sustainability" and self-sustaining mechanism. "Such a typology that constitutes almost 93% of the Islamic heritage stock in Cairo had a regular maintenance plan until Mohamed Ali changed their maintenance policies, and the building's condition started to decline".

The significant event and natural disasters that can cause damage to architectural stock are the main motives behind special restoration campaigns in Egypt during the Mamluk era. Their appreciation of the remarkable buildings and their desire to keep expressing the authority and glory of their power helped in shaping a well-defined track in restoration in Egypt (Steinberg, 1996). After an earthquake, there was three main commission led by three different rulers dedicated to the restoration work of the affected building and rebuilding some of them. Each commission had a specific target and was following a particular way of restoration, however, according to historians, all of the commissioners shared one main common philosophical principle; which the differentiating between the layers of intervention from the original parts of the buildings, and till now this is the unbreakable role in ethical conservation action.

3.1. What shaped an old cultural problem that affected the conservation policies in Egypt today?

All the variable historical events, different movements in administrational frameworks,

and critical times, in the past, have influenced and formed an accumulated attitude in perceiving and recognizing the cultural heritage. In Europe, the world wars and the era of modernization changed radically the societies and the face of conservation; as they were striving to save the remains of their cities.

3.2. The French invasion and "Description de l'Egypte"

Despite the political aims behind The French occupation of Egypt for three years from 1798 to 1801; it significantly altered the conservation and heritage recognition. One of the unrevealed aims is to sort out the treasures of Egypt and document them for economic reasons. Thus, Napoleon appointed 150 scholars to accomplish his scientific expedition to study the economical, historical, and social situation in Egypt and produce the masterwork "*Description de l'Egypte*". The extensive documents that include sketches, drawings of public life that depicted the Egyptians daily life, mappings, remarks regarding the social and economic activities, produced the foundations of "modern Egyptology". The various copies and volumes of this work, besides many art pieces from Egypt, had been transferred to Europe there, which formed an exceptional tendency towards Egypt and its cultural legacy (Rezk & Rabie, 2019). The international interest in studying its antiquities encourage the commissioners to develop their work in restoring historical monuments in Cairo but they approached the buildings from an orientalism perspective and imposed the tendency of "orientalists revival style".

3.3. The role "Comite de monuments de l'Egypte" in protecting monuments

The first formal institution that was mandated with the maintenance of heritage was the "le Comite de monuments de l'Egypte" in 1881. After the French occupation, Egypt became under the authority of Mohamed Ali who had a striving aim to modernize Egypt. He proceeded with transforming Cairo to be "Paris of the east" by altering its original fabric passing over the national identity as an extension to Napoleon's intentions. The Parisian boulevards cutting through the historic fabric had a profound impact on changing the face of Cairo and erased many historical buildings for the sake of this project.

Another major impact is the rift between the community and "Al-Awqaf" after the termination of its original maintenance policies. He formed another administration dedicated to the maintenance of public buildings, which afterwards, put "AL-Awqaf" out of service, and left for decades to deteriorate and be exploited (Mahdy, 2017). By the time, these godforsaken buildings lost their role in the society because the secular administrations planned to control heritage instead of preserving it and couldn't replace the traditional religious management of such typology.

The committee was run by foreigners mainly French that imposed the "stylistic" approach as the prevailing attitude towards the monument. The "orientalism" direction lasted for almost a century and considered the Islamic legacy as "dead buildings" with no value to their society or function (Mahdy, 2017). This rift between the community and their heritage is similar to the rift in Europe after the french revolution in a deliberate attempt to separate heritage from their cultural context. Nevertheless, the majority of the Egyptian population were not aware of this schism which reflects on the very low level of awareness of their cultural heritage and identity, even the educated elite who were influenced by orientalism and didn't comprehend the disconnection in the history and its consequences.

3.4. Pan Arabism

With the declaration of the Republic of Egypt and its independence, a new nation was established by Gamal Abdul-Nasser based following a secular notion to sustain the modernization plan, which naturally deepened the gap between the original traditional identity of the society and the new imposed ones. Due to the political unrest and the was in 1965, many conservation projects stopped and decreasing the international funds for minimal restorations with more governmental restrictions.

After the war and delocalizing thousands of Suez Canal and Sinai displaced inhabitants into

dilapidated buildings in old Cairo, the condition of the buildings became worst until the 70s when Cairo was listed as a world heritage site. The national and international attention it gained as a national income source made it liable for more exploitation (Frey & Steiner, 2011). For almost a decade, the projects and interventions at that time in historic Cairo aimed at supporting tourism disregarding the locals who had been delocalized and left their place where they built a coherent cultural network.

3.5. The Egyptian revolution in 2011

In the 80s, Egypt concentrated its efforts on political and economic strikes. The establishment of various institutions with ambiguous agendas and vague lows affected the conservation track because of the inconsistent coordination between the different parties. The conservation actions were not very prosperous because the state was weak and couldn't save heritage buildings from exploitation and vandalism. After the revolution in 2011, the situation became worst and worst; bands of outlaws broke into museums, looted artefacts, and demolished some heritage buildings. By statistics from the NOUH organization, Egypt has lost more than 70% of the heritage buildings in the three years following the revolution.

The revolution and its subsequent uprisings and turmoil, uncovered serious facts regarding the conservation approach in Egypt. moreover, the halt of tourism left the heritage buildings in complete ignorance from the government and the absence of risk management. However, the lack of funds and the termination of conservation projects saved many buildings from inappropriate and dreadful interventions and further destroy the revolution flattened the conservation practices, which gives us a pause and time to rethink our national plans and strategies.

4. Why do we need an Egyptian national charter?

The whole process of conservation starts with values and ends with values that are shaped differently according to the context. According to the nature of the evolution of the science on conservation in the western side of the world where the context changes radically than the eastern parts, and for a long time we have been following the tendency of universal values; the true recognition of the true values of heritage emerges from the inclusive analysis and reading of the history of a certain context and element to be able to develop a robust consciousness (Meskell, 2014). The recent approaches evoke the uniqueness and originality of heritage which is strictly linked to the social and cultural accumulation and it needs to be preserved itself.

Today's historians claim that the future of conservation should be the domain where culture and technology become the two faces of one coin and urge the need of developing a national approach taking into consideration previous experiences. A national approach is drawn from the social reaction to the conservation actions. Riegl claiming that the process of building a social consciousness should follow an uninterrupted history (Rezk & Rabie, 2019). Consequently, it's essential to follow a scientific methodology to evaluate the cultural actions in conservation projects and to recognize the various set of old and new values according to their defined attributes after the proper study of the history of monuments and the nature of the society, and their level of consciousness. However, such an essential step is still not present in Egypt because the society didn't shape his awareness of his cultural heritage regardless of the voices and efforts calling for a national charter.

The 18th century | Distinction between the restorer and the artist (conflict between Robert Picault and Jean-Louis Hacquin).

1789 | The French Revolution.

1798 | Napoleon landed in Egypt.

Mid-nineteenth century 1850 | Romantic Movement: Promoting New Attitudes toward Nature in America.

1858-1952 | Sa'ed basha established the antiquities agency. it was managed by french experts.

1859-1971 | The establishment of the agency of antiquities.

1863 | The establishment of the first natioanl museum in the middle east (the an-

1877 | Ruskin and Morris prepared the manifesto for the foundation of architectural conservation in the society for the protection of ancient monuments SPAB.

1881 | Abbas Helmi the second established the Arabic antiquity conservation

1882-1950| Arabic antiquities conservation committee.

1882-1922| The British colonizstion of Egypt.

Beginning of the 20th century | Theoritical base was established, especially after Cesare Brandi to the modern conservation.

1903 | "The modern cult of monument" by Alois Riegl.

1904 | The first architecture congress in Madrid.

1930s -1940s | The development of museum conservation laboratories and socialists movement.

1919 | Revolution against the British occupation of Egypt and Sudan.

1931 | Athens first charter.

The 40s | Major appreciation of the value of the historical city centers and after the world war II in European cities. From traditional working-class to a more scientific approach.

The 50s | The science of conservation as a specialization and independent study.

1950 | Department of antiquities.

1953 | The use of the term Integrity.

1954 | First Venice charter.

1954 | UNESCO convention.

1954 the UNESCO convention for protection during wars | Concerning the protection of the world cultural and natural heritage.

1960s | After the revolution the committee dissolved.

The 60s | Theoritical issues were hotly debated especially after the awarness of losing unique monuments.

1960 | The antiquities authority followed the ministry of culture.

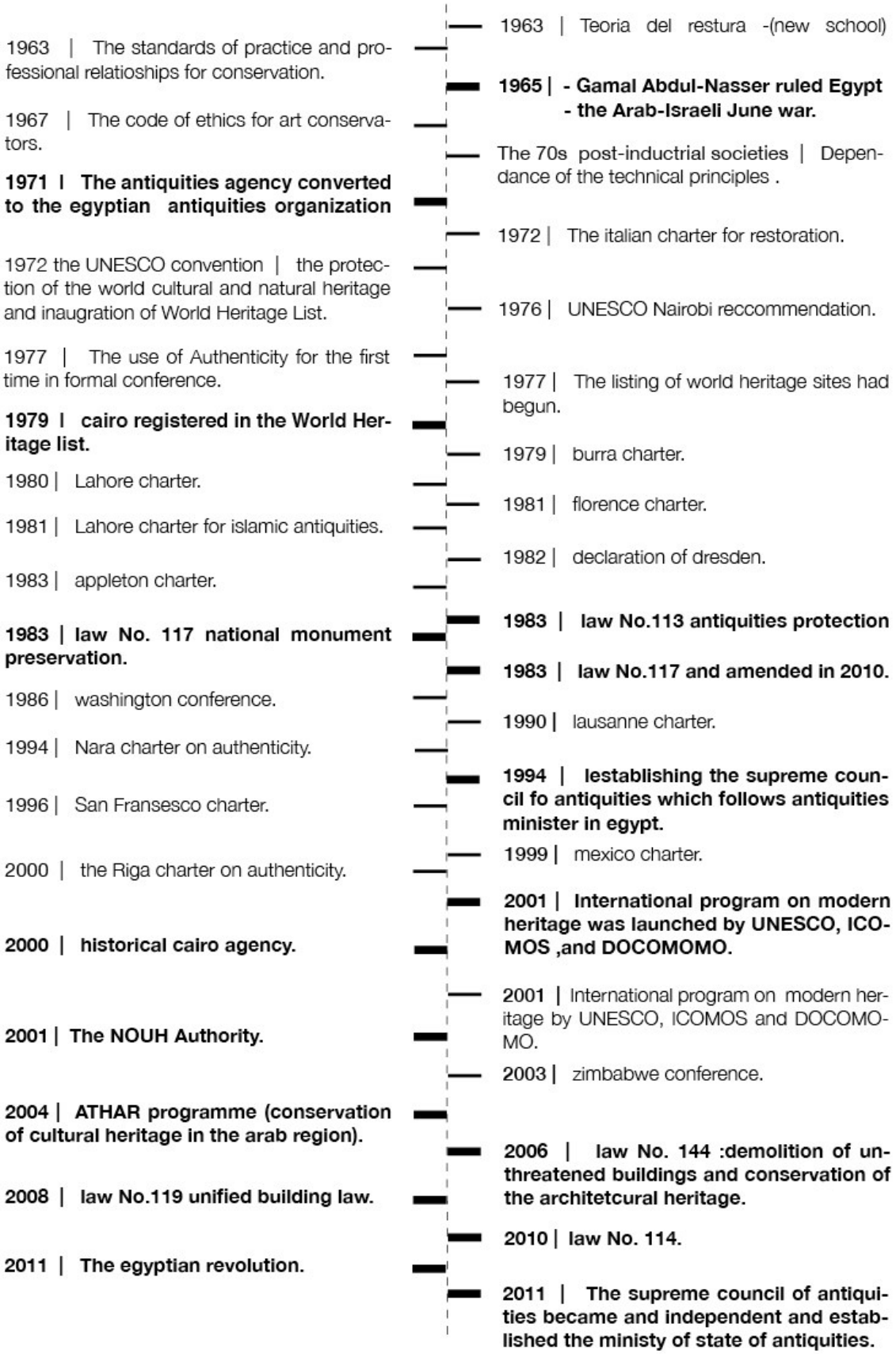

Figure 1. A timeline of the evolution of conservation in the international track and the Egyptian one in bold (Developed by the authors).

5. Conclusions

Before the evolution of "cultural heritage" as a concept and a scientific field, the protection of heritage buildings and monuments, the conservation was formed through three main stages. First, the idea of restoration during the renaissance was characterized by "stylistic restoration" as a result of the romantic approach towards national monuments. Second; the idea of preservation provokes the mere protection of buildings from further deterioration. And finally, the idea of conservation includes both restoration and preservation but following a scientific approach in determining the level of intervention. After the modernization, the definition of conservation kept changing in theories and treaties to be more inclusive and tackle more social and cultural aspects in an attempt to develop a mechanism to assess heritage buildings and identify their values.

The broad notion of conservation surpassed the western boundaries after globalization and started to take another shape and be adapted to fit in another context and function properly. But such a progression was limited to a certain case, therefore the limitation and vagueness of some principles were revealed and had to be revised to be applicable somewhere else. The Cultural response to conservation actions and the greater idea of preserving heritage do not contradict each other's philosophically nor morally, in other words, the recasting of conservation plans based on the social, cultural, and economical dimensions of society urges the need for a national charter that conforms to the needs and essence of the society.

Although The idea of protecting national monuments in Egypt was always there since the ancient Egyptians, Egypt couldn't develop its approach, nor the Egyptians managed to build a cultural consciousness towards their heritage due to the deliberated schism between the society and their continuous history. The various regimes dropped behind the national identity and the conservation actions were not linked to social existence. But all the international efforts and the global debate regarding the connectivity between successful conservation and the need for individual value-based assessing of monument; are valuable material for Egypt to establish its conservation management policies and to relink the people with their heritage.

For further investigations and a better understanding of the history of conservation in Egypt, extensive research and documentation of previous and current practices must be conducted and including all the needed data to be shared with the public. Moreover, further studies on social indicators are much needed to indicate the social response to conservation actions in Egypt, therefore better monitoring of the process and the after-plan phase.

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Conflict of interests

The authors declare no conflict of interest.

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Enhancing Security in Affordable Housing: The Case of Prince Fawaz Project

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ABSTRACT

The present study argues that the urban form of affordable housing projects affects safety and security. The study examines the level of safety and security in the Prince Fawaz project proposing recommendations that enhance it. Theories and approaches concerned with the environmental crime are initially reviewed. Then, urban and architectural features as well as crime rates and patterns are documented. Also, trace and behaviour observations are carried out. The observations monitored urban features and behaviours associated with crime or fear of crime. Residents' perception of security and fear of crime is extracted through a questionnaire. A Space Syntax is processed and linked with the questionnaire and observation outputs. Observations demonstrate a semblance of fear of crime which is supported by records of car and home theft. Although the questionnaire reflects a suitable level of security, it points to peripheral spaces and areas around mosques and shops as the less secure. However, enhancing security in the Prince Fawaz project requires urban interventions including controlling access to peripheral spaces, reviving areas detected to be unsafe, repositioning elements causing visual obstacles and enhancing appearance by vegetation and sustainable maintenance. Besides, reformulating the movement network so that an appropriate integration between residents and strangers is achieved. On the conceptual level, the study proves that none of the theories of environmental crime can act as a comprehensive approach; but each can partly work.

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1. Introduction

With the economic prosperity of the mid-seventies, the Saudi government began to build many housing projects to meet the growing population and the immigration from villages to cities (Al Hazza', 2001). Traditional society is in general deeply religious, conservative, and family-oriented. Whereas in the urban lifestyle, fathers used to absent outside the home for long hours, women went to work relying on foreign nannies and maids in

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raising children, and sons acquired more freedom. The recruitment of labour from different nationalities led to noticeable social changes. Social networks have made the new generations more vulnerable to changes in beliefs, behaviours, customs and traditions, and religious values. The socio-economic changes caused pressures that led to a rise in crime rates and the emergence of new types of crime (Abdullah Eben Saleh, 1999; Al Beshr, 2000).

The crime rate in Saudi Arabia is generally low compared with other countries. Though, in 2005, the number was significantly raised to about 90000 crimes, with a rate of 392 crimes per 100000 people. By the year 2006, the number of criminal offences dropped to 88609 with a rate of 354 crimes per 100000 people (Abu Shama, 2007). During the year 2014, the number of crimes reached 96000 but with a rate of 311 crimes per 100000 people (El-Torky, 2015). The number of crimes in 2016 reached 149781 with a rate of 464.46 crimes per 100000 people. This number dropped by 4.5 per cent in 2017 (SABQ, 2017). During the last three years, the Saudi government is adopting serious reforms in its economic policy causing a huge number of job's lay off of foreign labour and accordingly dramatic socio-economic changes took place. Without specific figures, OSAC Crime and Safety Reports of 2019 and 2020 indicate that crime in Saudi Arabia has increased but remains at levels far below most major metropolitan areas (OSAC, 2019, 2020).

It is worth mentioning that Saudi Arabia has two types of police forces namely general and religious. The general police are responsible for national security and crime investigation. While, religious police is in charge of enforcing religious customs of "Sharia" (Like segregation of sexes, the prohibition of alcohol, men attending prayer, suppression of non-Muslim displays, and the modesty of women.) (Pietenpol et al., 2018).

Crime in residential areas is a vital issue because it affects the work of police departments, real estate agents, and residents. Crime, or fear of crime, has a direct reflection on outdoor activities, psychological status, communal relationships as well as real estate value (Marques et al., 2018). Ghani (2017) argues that the frequent occurrences of crimes in urban area instil fear and accordingly reduce economic opportunities, safe living and quality of life. Crime reduction can be an effective tool for investment in the housing sector (Lacoe et al., 2018); this is crucial for affordable housing.

Literature does not establish that urbanization causes crime, but it is linked with a crime because it harbours many people which some of them may tend to crime (Soh, 2012). Yet, in many instances, the urban configuration of the residential area contributes to making a settlement an attractive area for crime (Lorenc et al., 2012). The relationship between crime and urbanism attracted the attention of architects, planners, sociologists, criminologist and policemen. There are some theories, approaches and tools that aimed at promoting security and reducing opportunities for crime and risk in the built environment. Theories include the Defensible Space, Broken Window and Crime Prevention Through Environmental Design (CPTED) (Adel et al., 2016). New Urbanism is an urban design approach that, among other objectives, advocates safety from crime (CNU, 2001). Alongside other applications, Space Syntax seeks to find explanations for the places in which crime incidents occur (Hillier & Sahbaz, 2008).

The problem of understanding the impact of urban design on crime lies in the complexity of measuring this relationship. Although many attempts have been made worldwide, it is receiving inadequate interest in Saudi Arabia. Therefore, the present paper is an attempt in this direction.

2. Material and Methods

The research reviews theories and approaches concerned with the relationship between urban design and security, crime and fear of crime. In the case study, many techniques are utilized. First, data related to Prince Fawaz affordable housing project is gathered including rates and patterns of crime over the last three years. Second, a trace observation is tackled to monitor features associated with crime or fear of crime such as fences, protection iron and visual obstacles. Third, behaviour observation detects activities that might have a relationship with crime. Fourth, a questionnaire is conducted to explore levels of security in different spaces, places and times in which residents feel more vulnerable to crime, previous experience with crime, and prevailing types of crime. A sample of 360 questionnaires was distributed covering about 27% of the

project' units. The sample realizes a confidence level of 95%. The questionnaire form includes several closed-ended questions with bilateral answers; while, others are formulated in a Likert-type scale. At the end of the questionnaire, residents are asked about their suggestions for enhancing security. The urban pattern of the Prince Fawaz project then processed with Space Syntax. With Depthmap, many measurements are derived, and data obtained from observation and questionnaire are correlated. An interpretation of concluded results accompanied by recommendations for enhancing security and reducing crime in the Prince Fawaz project are then discussed (Fig. 1).

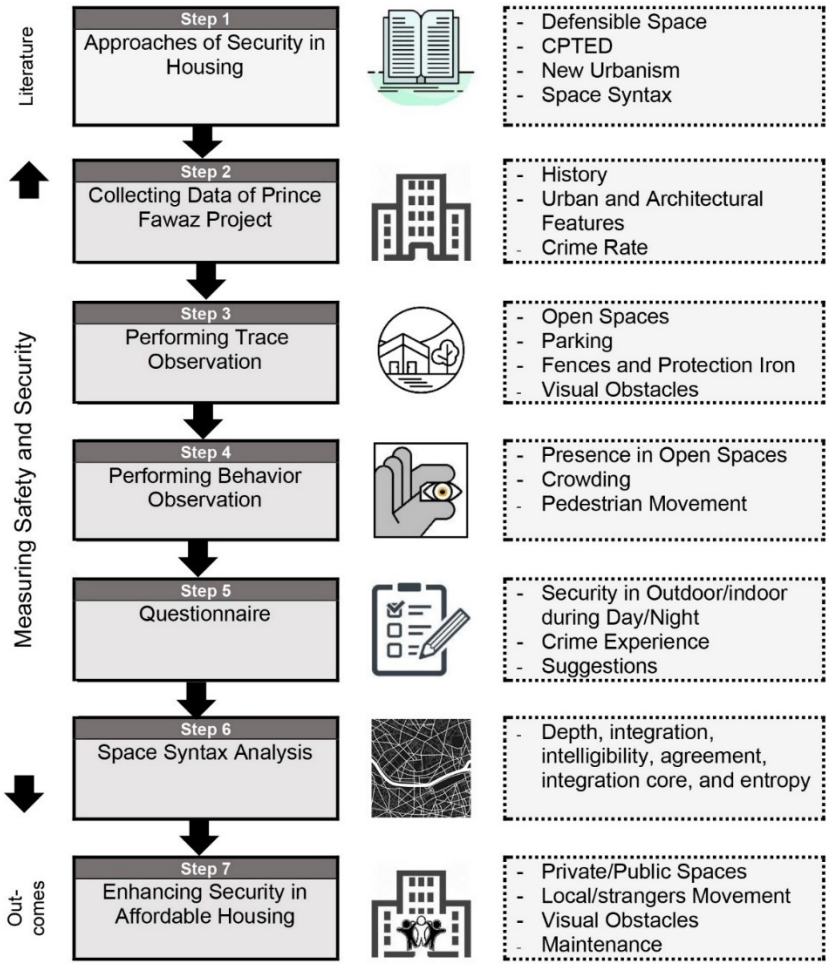

Figure 1. Research Methodology.

3. Theory

The relation between crime and the built environment has been the interest of environmental criminology (Anna Alvazzi del Frate, 1993; Brown & Altman, 1983; Cozens, 2002; Yazdanfar & Nazari, 2015). It is based on the idea that criminals take geographic factors into account when deciding on crimes (Bartol & M., 2006). Many theories and applications were built on environmental criminology such as rational choice, routine activity and crime pattern (Malleson & Birkin, 2012; Shon & Barton-Bellessa, 2015; Wilcox, 2015). However, several attempts have been made to derive criteria that can enhance security and reduce crime in housing communities as discussed below.

Defensible Space: Oscar Newman's 'Defensible Space', introduced in 1972, was based on four design elements including territoriality, natural surveillance, image and milieu (Zen & Mohamad, 2014). The theory advocates the consensus between a homogeneous group of inhabitants in a specific urban context which includes a hierarchical system of open spaces, with the maximization of private and semi-private spaces on the account of public and semi-public ones. Accordingly, access to an area should be limited to legal users whereas strangers are believed to be the source of danger. Defensible Space adopts the separation of residents from strangers, whether

by physical or symbolic means (Newman, 1972). However, if Defensible Space could succeed on a limited scale, it will be difficult to be replicated at the city level which, according to Hillier (2004), will transfer into segregated islands leading to encouraging criminal activities and increasing the fear of crime. Empirical studies did not support Defensible Space too (Cozens et al., 2001).

Crime Prevention Through Environmental Design (CPTED): CPTED is affected by Defensible Space in terms that the safe community must enjoy a sort of control on danger, personal threat and crime (Mohit & Hannan, 2012). CPTED aims to make the physical context safe for normal users but make it uneasy for abnormal users to engage in inappropriate behaviour. CPTED relies on strategies including territoriality, surveillance, consolidated activities, controlled accessibility, sustainable maintenance and good management, and target hardening within geographical juxtaposition (Ha et al., 2015; Piroozfar et al., 2019). Natural surveillance in live spaces will thus discourage crime. Meanwhile, assigning clear functions for spaces accompanied by sustainable maintenance and management is expected to leave a limited chance for crime. So, CPTED is embodied in the Three-D Approach which includes "Designation" concerned with the activities assigned for spaces, "Definition" concerned with the physical boundaries of spaces, and "Design" concerned with the practice of desired uses in a safe manner (Marvi & Behzadfar, 2015; Sakip & Abdullah, 2012). Like Defensible Space, empirical studies prove that CPTED outputs are not confirmed (Elbadawi, 1991; Hardy, 1997; Robinson, 1997; Serpas, 1998).

Broken Window: Broken Window theory believed that serious crimes occurred as a result of a series of minor crimes. The theory links crime with disorder and argues that if the disorder was eliminated then serious crime would not occur (Austin et al., 2002). Thus, a well-maintained environment could reduce and prevent criminal activities. This link has been shown to be often non-existent (Harcourt, 2009). The theory has been criticized for being only a short-term solution, not a robust theory (Taylor, 2001; Thacher, 2004). However, the theory reinforced the principles of natural surveillance and territoriality.

New Urbanism: The approach tried to avoid the criticism of urban design for its lack of humanity, responsiveness, sensitivity as well as lack of safety from crime. Unlike Defensible Space, New Urbanism adopts expansion in public spaces to encourage interaction between users and strengthen the sense of affiliation, the mixture of uses to support the vitality and increase the presence of people in streets, encouraging walkability by utilizing grid pattern of streets, allocating buildings adjacent to streets to enhance natural surveillance, and finally increasing densities (Elshater, 2012). However, Foster et al. (2016) argue that New Urbanism may deliver social and wellbeing benefits but its impact on creating safe space is still subjective. Evidence from criminology links the main features of New Urbanism with increased levels of crime. For instance, the non-residential land uses which constitute destinations to walk to have been associated with an elevation in property crime levels. Likewise, street connectivity is a fundamental aspect in new urbanism to provide direct and varied walking routes for residents; yet, streets are also easily navigated by offenders with more options of escape routes (McCord et al., 2007).

Space Syntax: Space Syntax as a configurational analysis method was established by Hiller in 1984 based on the research of Hiller and Hanson on the concept of "Social logic of space" (Hillier & Sahbaz, 2005). The technique is applied to examine how the physical or visual accessibility of a spatial system affects the social behaviour of users; eliminating crime is one of the main concerns. In a spatial system, the value of accessibility of a street segment from all-around ones is identified by two measures which are integration and connectivity. In residential areas, studies demonstrate that streets that enjoy a higher integration value, and hence higher accessibility, enjoy more security levels than segregated ones (Ballintyne et al., 2000; Elgarmadiand & Özer, 2018). The presence and social interaction within a space prevent criminals from committing a crime because they could be easily caught then. But it does not seem that the relationship between urbanism and crime is identified by accessibility only. Many studies demonstrate conflicting results according to variations in income level, density and education (Nubani & Wineman, 2005). Sonia Hirt and Zahm (2012) argue that as

long as the city has inconsistent types of open spaces, movements and activities, crime rates will unexpectedly vary from one area to another. This is confirmed by Hagan and Daigle (2018) who emphasize the fact that there is no absolute right or wrong in criminology. Table (1) summarizes the above discussion.

Table 1. Theories of environmental criminology, corresponding implications and impacts.

Theory/Approach	Main concept/principles	Implication to urban design	Impact in practice
Defensible Space	Territoriality, geographical juxtaposition, natural surveillance, image and milieu	- Minimized common areas - Maximized private ownership - Boundary definition - Minimized permeability	- Results are not confirmed
CPTED	Territoriality, natural surveillance, access control, activity support, image management, geographical juxtaposition	- Mixed land use - Border definition of controlled space - Clearly marked gathering areas - Reduce use conflicts with natural barriers - Overcome distant and isolation	- Crime levels dropped, but - Encouraging burglaries crime - Reduction of crime in the town centres not in housing areas
Broken Window	Well-maintained environment, natural surveillance and territoriality	- Regular maintenance	- Could reduce and prevent criminal activities - Short-term and partial - Failed to consider collective efficacy
New Urbanism	Vitality and sense of community, walkability and minimum car dependence, and natural surveillance	- Expansion in public spaces - Mixed land use - Grid pattern of streets - Buildings adjacent to streets - Compact development - Increasing densities	- Linked with increased levels of crime - Still subjective
Space Syntax	The increased accessibility and social interactions (reflected in Integration and Connectivity measures)	- Enhancing pedestrians and vehicles movement	- Results widely varies depending on income level, density and education

Vegetation is an integrated component of urbanism. Like the built environment, the impact of vegetation on crime is still questionable. From one side, vegetation is believed to encourage crime as it can help to conceal criminals while they plan and execute crimes and then disappear (Nasar et al., 1993). Also, being visual obstacles, vegetation limit visibility and hence promote fear (Nasar & Jones, 1997). Donovan and Prestemon (2010) indicate that smaller trees that obstruct visibility were associated with increased crime in residential areas. On the other side, the latest research argues that well-maintained vegetation enhances reducing rates in certain types of crime. Studies attribute the reduction in crime rates to increased surveillance in vegetated spaces and the delightful mode resulting from the landscape. For instance, rich vegetation is considerably associated with lower rates of assault, robbery, and burglary, but not theft crimes (Wolfe & Mennis, 2012). Maas et al. (2009) argue that, in residential areas, vegetation could effectively decrease fear of crime, enhance the sense of safety and reduce reported crime. In large Neighbourhoods, vegetation contributed to reducing violence and property crime (Kuo & Sullivan, 2001). Moreover, Donovan and Prestemon (2010) found that large private trees and street trees enhanced lower crime rates. Finally, the greening of vacant plots could reduce gun assaults and vandalism (Branas et al., 2011).

4. Case Study

Prince Fawaz project is located about 10 Km from the centre of Jeddah on Jeddah-Mecca highway which intersects with Prince Fawaz road splitting the project into four distinctive

zones: A (602 units), B (200 units), C (314 units) and D (202 units) (Fig. 2). Each zone is divided into blocks including some two floor detached dwellings that are dedicated to mid-income Saudi families (Fig. 3). The project enjoys many public services such as mosques, open spaces, shops, a sports centre and primary, middle and secondary schools.

Figure 2. The layout of Prince Fawaz project, Jeddah (Source: Google Earth, edited by the author).

Figure 3. A typical dwelling of the project (Source: The author).

4.1. Crime Rates and Patterns in Prince Fawaz Project

Rates and types of crime in the Prince Fawaz project during the last three years (2017-2019) are summarized in Table (2). Unfortunately, the information does not include the location of the crimes. The table indicates that crimes in the project are classified into four types: money molesters, self-molesters, moral and juveniles.

Data in the table (2) show that, during the year 2017, the number of money molesters' crimes reaches figure 33 i.e., 52% of the total number of crimes. Car theft, with the number of 16 crimes, is the highest on the list representing 25.3% of the total crimes. Moral crimes, including sexual offences and drinking alcohol, reach 17 crimes, i.e., 26.9% of the number of crimes which makes them come second. Drinking alcohol topped the list of moral crimes with the number 12 representing 19% of the total crimes. The number of self-molester crimes reaches 12 i.e., 19% of the total crimes.

During the year 2018, the number of reported crimes has doubled reaching 116 crimes. Again, money molesters' crimes come in the first place with a number of 63 criminal offences, i.e., 54% of the total number of reported crimes. Car theft topped the list followed by home theft with the numbers of 27 and 13 crimes respectively. Moral crimes reach 32 crimes, i.e., 27.5% of the total number of crimes, mostly like the previous year. Although the number of self-molester crimes rose to 17, its percentage of the total number fell to 15% of the total crimes.

In the year 2019, the number of crimes in the project declined to reach 77 crimes, i.e., 66% of the number of 2018, and slightly exceed the record of 2017. Still, money crimes, which amount to 45, represent about 58% of the total number of crimes. Car theft topped the list followed by home theft with 22 and 10 crimes respectively. Moral crimes reach the number of 20 representing 26% of the total crimes. While self-molester crimes dropped to 8 representing about 10% of the total crimes.

The above figures indicate that although the total number of crimes varies among the three years, the number of money molesters' crimes is the highest followed by moral crimes and self-

molester ones. The rate of money molesters is rising (52%, 54% and 58%); and car theft is always on the top of records representing a quarter of the crimes along the three years (25.3%, 23.3% and 28%). Home theft, which comes in the second place of money molesters, is alarming as its rate is increasing (7.9%, 11.2% and 13%); it is almost doubled over the three years. However, the rate of moral crime is steady over the three years (26.9%, 27% and 26%); while, the rate of self-molesters is decreasing (19%, 15% and 10%).

Table 2. Numbers and types of crime committed in Prince Fawaz project 2017-2019

		2017		2018		2019	
Classification	Crime type	Rate	Time	Rate	Time	Rate	Time
Money molesters	Car theft	16	2 am -12 pm	27	1 am - 10 pm	22	1 am - 10 pm
	Shop theft	1	10 am - 12pm	0	8 am - 10 pm	0	8 am - 10 pm
	Home theft	5	2 am - 12 pm	13	2 am - 12 pm	10	2 am - 12 pm
	Theft	1	10 am - 4 pm	2	1 am - 8 pm	1	2 am
	Theft attempt	0	-	5	9 am - 9 pm	1	7 am
	Ravage	1	10 am - 11 pm	2	1 am	1	1 am
	Sorcery	2	8 am -10 pm	7	7 am - 11 pm	2	7 am - 11 pm
	Fraud	7	1 am - 10 pm	7	5 pm - 12 pm	8	5 pm – 12 pm
Self-molesters	Brawl	2	6 am - 11 pm	1	3 am - 10 pm	1	3 am -10 pm
	Scrimmage	8	1 am - 12 pm	11	1 am - 11 pm	3	1 am - 12 pm
	Weapon possession	2	2 am - 12 pm	5	4 am - 10 pm	4	4 am - 10 pm
Moral	Sexual offenses	5	1 am - 12 pm	7	1 am - 12 pm	4	1 am - 12 pm
	Drinking alcohol	12	4 am - 12 pm	25	4 am - 10 pm	16	5 am - 11 pm
Juveniles	Absent	1	6 am - 12 pm	3	5 pm - 12 pm	2	5 pm - 12 pm
	Embezzlement	0	-	1	11 am	1	10 am
	Total	63		116		77	

Source: Figures were obtained from Prince Fawaz Police Office, classified and arranged by the author.

4.2. Trace Observation

Open spaces: There are several open spaces permeating the residential units, these spaces are characterized by dereliction, so they are mostly transferred into the junkyard where domestic, gardens and construction waste are dumped. In peripheral spaces, a very little number of alcohol bottles and cans are detected. However, many of these spaces are connected to both exterior and interior roads which makes them uncontrolled access into the project. In response, some residents surrounded these spaces with fences, annexed them to the private gardens, or arranged them as playing areas (Fig. 4).

Parking areas: Residents used to park cars in streets in front of their units. Parking areas are directly overlooked from the dwelling or the guard room. Most of the parking spaces are surrounded by iron fences, strings or chains (Fig. 5).

Fences: Fences are heavily utilized everywhere in the project. They are raised to more than six meters. In many instances, high fences isolate residents from viewing outside (Fig. 6). Even public buildings like mosques and schools are surrounded by high fences.

Protection iron: The heavy use of protection iron is observed in all dwellings on doors, windows, and air-conditioners.

Visual obstacles: Visual obstacles are noticed in the project including water tanks, electric transformers, garbage containers and enclosed parking areas, which have heights that outweigh the rise of an adult person. The location of those elements and their impact on visual scopes does not follow any criteria, though they are abundantly existing in main streets especially those leading to mosques. Moreover, trees and shrubs planted by residents to offer privacy for their families enhance visual isolation (Fig. 7).

Figure 4. Open spaces either neglected or seized by adjacent units (Source: The author)

Figure 5. Parking areas are exposed or protected by fences (Source: The author)

Figure 6. High fences are utilized to achieve privacy and protection (Source: The author)

Figure 7. Different types of visual obstacles (Source: The author)

Observation indicates that inhabitants do not seem to enjoy a satisfactory level of security. The heavy use of fences, strings, chains, protection iron-on dwellings and parking areas reflects the fact that there is a fear of theft. This could be justified by the numbers of theft, and car theft crimes illustrated in the table (2). The deteriorated situation of open spaces seems to generate a feeling of fear as argued in theories. Likewise, ambiguous or screened areas created by visual obstacles sustain such feeling.

4.3. Behaviour Observation

Behaviour observation concentrates on the activities that have a direct or indirect relationship with crime or fear of crime. Some activities and behaviours could be recorded including:

- The scarcity of children or adults in the open spaces or streets; their presence is limited in better-off spaces utilized as gardens or playing areas.
- Scattered groups of teenagers are noticed in periphery open spaces.
- Foreign labour (porters, drivers and home labour) gathers in front of dwellings.
- Zones D and A are more teeming than the others according to the presence of shops, while areas B and C enjoy a well socio-economic look.
- The pedestrian movement is rather low except during prayer times when some residents go to and return from, the mosques.

Behaviour observation can support the idea that inhabitants do not seem to enjoy a satisfactory level of security as derived from trace observation. The uncontrolled open spaces attract youth from adjacent areas to play in which sometimes ends up with scrimmage. They also attract foreign labour to skulk and drink alcohol. So, families seem to avoid such spaces. This could be also justified by records of scrimmage and drinking alcohol crimes. However, the absence of inhabitants in open spaces could be partly attributed to the hot-humid weather.

4.4. Questionnaire Analysis

The questionnaire contains questions concerning crime experience and feeling of security in different spaces during day and night as argued below:

- About 49% of the respondents do not allow their children to play in outdoor spaces, while 51% of them do. Whereas, 73% of the respondents do not feel worried about their children while playing outdoors. Despite this, 71% of them allow their children to play in the region while 29% of them do not do so. Being worried then does not prevent families from allowing their children to play outdoor, which means that they do not consider the area unsafe to the extent that requires preventing children from playing outside while preventing children refers to reasons unrelated to security. No significant differences among the four zones of the project were detected.
- Residents consider their dwellings very safe with a median of 4.59 during the day and 4.41 during the night (on a scale from 1 to 5) respectively. A less degree of satisfaction was detected in the western zones (C, D) during the day with a median of 4.21 and 4.38 for clusters C and D, and during the night with a median of 3.96 and 4.14 compared with zones A and B that recorded a median of 4.73 and 4.78 during the day and 4.43 and 4.73 during the night.
- Residents consider the main roads leading to their dwellings safe during day and night with a median of 4.08 and 3.65 respectively; likewise, frontal streets and spaces with a median of 4.19 and 3.86 respectively, and rear streets and spaces with a median of 4.03 and 3.59 respectively. With that level of satisfaction, there is no logical explanation for protection fences built around parking areas in front of dwellings unless such satisfaction was achieved after erecting the fences. Again, a less degree of satisfaction was detected in the western zones during the day compared with the eastern ones with a median of 3.69 and 4.06 respectively, while no significant difference among the four zones was detected during the night.
- Residents consider spaces surrounding the mosque safe during the day, but this satisfaction decreases during the night to a neutral level with a median of 3.65 and 3.31 respectively. Different levels of satisfaction among the four zones were detected with a median of 4.06, 4.21, 3.58 and 3.75 for clusters A, B, C and D respectively. It is noticeable that the satisfaction level in spaces surrounding the mosques is less than those around the dwellings.
- Residents evaluate the commercial area rather safe during the day, but less safe to a neutral level at night with a median of 3.96 and 3.39 respectively. Again, a less level of satisfaction was detected in the western zones than the eastern ones with a median of 4.06, 3.75, 3.58 and 3.75 during the day, and 3.57, 3.53, 3.0 and 3.19 3.57 during the night for clusters A, B, C and D respectively.
- Residents consider the project boundaries safe during the day while neutral during the night with a median of 3.7 and 2.94 respectively. Residents evaluate the eastern edges as the safer where the eastern zones A and B achieved a median of 4.07 and 3.65 while western zones C and D achieved a median of 3.56 and 3.49.
- In general, residents give the project a positive evaluation regarding security without differences between the four zones achieving a mean of 3.79 during the day and 3.34 during the night.
- In terms of crime rate, the questionnaire clarifies some differences between the four zones. Respondents indicate that zone A is the top in crime rate where 19.3% of the residents exposed to crime. Zone C is in second place (13.3%) followed by zones B and D (12.1% each). Likewise, 42.2% of the respondents of zone A heard that their neighbours exposed to crime. While, those who heard about crime in zones D, C and B amount the ratio of 24.2%, 23.3% and 17.2% respectively (Table 3). By adding figures of both who "exposed to crime" and who "heard about crime", the aggregate number of crimes in the four zones can be monitored. Zone A is the highest (61.4%), followed by zones C and D (37.3%, 36.6%); while, zone B is the least vulnerable to crime (28.7%). The total aggregate indicates that 42.5% of the residents either exposed to crime or heard about crime.
- However, residents' proposals for enhancing security are limited in maintaining the neglected open spaces and removing garbage regularly.

Table 3. Crime rate indicated by respondents in the four zones.

			Exposed to crime			Heard about crime			Aggregate
			No	Yes	Total	No	Yes	Total	
Zone	A	Count	92	22	114	66	48	114	70
		% per zone	80.7%	19.3%	100%	57.8%	42.2%	100%	61.4%
	B	Count	83	11	94	78	16	94	27
		% per zone	87.9%	12.1%	100%	82.8%	17.2%	100%	28.7%
	C	Count	51	8	59	45	14	59	22
		% per zone	86.7%	13.3%	100%	76.7%	23.3%	100%	37.3%
	D	Count	82	11	93	70	23	93	34
		% per zone	87.9%	12.1%	100%	75.8%	24.2%	100%	36.6%
Total			308	52	360	259	101	360	153
			85.6%	14.4%	100%	71.9%	28.1%	100%	42.5%

Results indicate that residents' evaluation of security in the project spaces is positive. Medians achieved in different spaces are all surpassing figure 3.39 except for the project boundaries and spaces around mosques at night. This can be justified by the absence of activities. Residents of the eastern zones (A, B) enjoy a better level of security than the western ones (C, D). The explanation for zone A could refer to the continuity of movement associated with shops as noted in theories above. Although zone C has a good socio-economic appearance, it does not seem to enjoy a high level of safety which makes issues like image and milieu questionable. However, the level of security inferred from the questionnaire is rather contradicting with the reported rates of crime and the observed tactics of protection. Such a level of satisfaction could be achieved due to the precautions taken by inhabitants to protect their properties.

4.5. Space Syntax

Prince Fawaz project is analyzed with Depthmap software. The maps produce a set of local measures (connectivity, depth, control, controllability and choice) and global measures (depth, integration, intelligibility, agreement, integration core, and entropy). The terminologies used are illustrated in the appendix.

Figure (8. left) illustrates the integration map of the project; the map indicates that the north-south axis is the most integrated. The segments perpendicular to the north-south axis, and surrounding the four zones, have high integration values too. These lines represent the spine of the project; they connect the four zones but do not penetrate any of them. This is clarified more in Figure (8. Right) which represents lines that are 25% more integrated (integration core). Most integration core segments are located on the borders of zones with a limited number that penetrates them. This confirms the fact that each zone of the four acts as an isolated entity with a little relationship with the others. Zone A is the most penetrated, which means that it is more accessible than the others. Though, the questionnaire indicates that it is the highest crime rate. This, however, makes accessibility questionable.

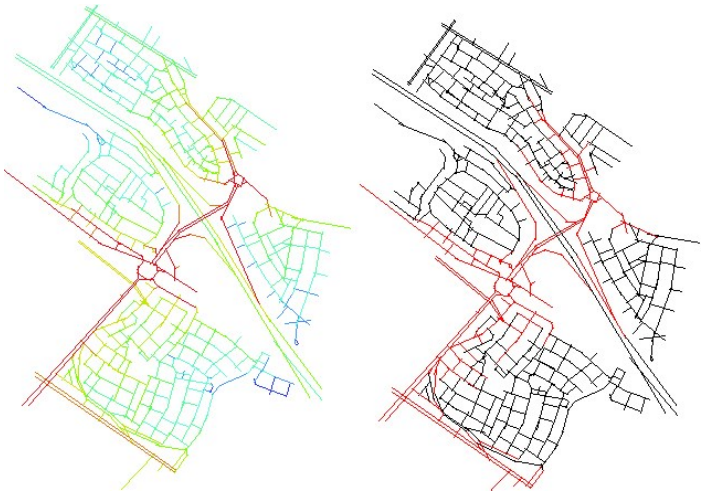

Figure 8. Integration maps, (Left) Project integration map; (Right) Lines 25% more integrated (Integration core)

The intelligibility value of the project, which amounts to 0.042, is relatively low compared to the average values available in residential areas which reach up to 0.7 (Fig. 9. Left and middle). Intelligibility value in zone A is relatively higher than other areas reaching the figure 0.123. The high intelligibility encourages strangers to navigate through the area. The low intelligibility value refers to the clear distinction between spaces (streets) that link between regions and the internal spaces in each zone. Despite the low intelligibility value for the project, the intelligibility value for pedestrians (diameter 3)1 is high with a value of 0.71. The intelligibility value for zone A is also the highest among others with an average of 0.74, making it more accessible for outsiders.

The relationship between integration and choice expresses the degree of compatibility between residents and strangers' movement routes. Figure (9. Right) illustrates a good relationship expressed by the regression coefficient (R2 = 0.421) for the project, i.e., streets that are jointly used by both residents and strangers are not few. In addition, the chart clarifies that three out of the four zones enjoy a high regression coefficient ranging between 0.52 and 0.56, while region A has a value of 0.339 only, i.e., the agreement between residents and strangers in this region is the least. This reflects the absence of natural surveillance imposed by the co-existence of both residents and strangers, which provides the opportunity for crime. This can be one of the reasons for the high number of crimes concluded throughout the questionnaire in this zone compared with the others.

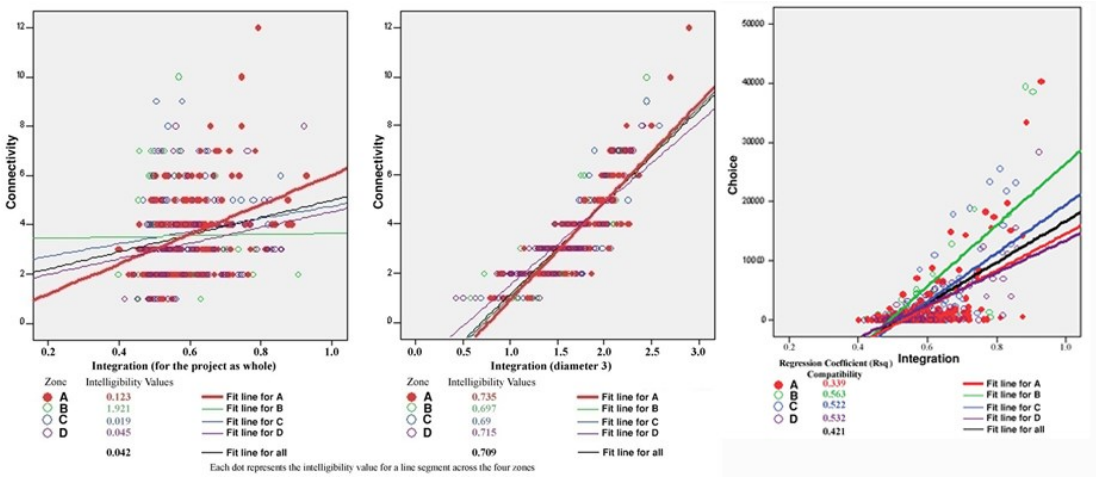

Figure 9. Left and middle: Intelligibility values of the project
Right: Compatibility between residents and strangers in the four sectors

In the light of the foregoing discussion, the high crime rate reduced in zone A can be interpreted, where many factors have led to this situation. First, the high values of both integration and intelligibility. Second, the relatively deep penetration of the core of integration into the region; makes the region more accessible by strangers. Third, and most importantly, the weak coincidence between spaces commonly used by residents and those easily accessed by strangers. The third factor eliminates the residents' control and surveillance of strangers, which seems essential for the security of residential areas.

5. Discussion and Conclusion

On the theoretical level, the case study shows that none of the approaches concerned with security in residential areas reached up to completion; but each has aspects that partly work. Prince Fawaz project clarifies that the unidentified, uncontrolled and inactive open spaces are unsafe areas that raise the residents' fear in accord with Defensible Space and CPTED. While Defensible Space claims

[1] The local measure proximity diameter 3 looks at the intelligibility of the 3 closest axial lines from the starting axial line; a distance which is appropriate for walking. A high (diameter 3) intelligibility implies that a line segment and the 3 closest axial lines are important for pedestrian movement through the system; or that the area can be conceived from these parts.

territoriality and access control, the case study shows that streets in which residents and strangers' movement matches enjoy a higher level of security. This agrees with CPTED, New Urbanism and Space Syntax. To enhance security in affordable housing, it is suitable to examine it case by case. A detailed record for types, places and time of crimes is a major component. A comparative analysis of projects can help to refine the results too.

Based on trace and behaviour observation, as well as the questionnaire, the periphery open spaces constitute unsafe areas. Space syntax illustrates that they are accessible by outsiders with little compatibility with residents. Such spaces provide uncontrolled access to the project resulting in a threat for the residents. Controlling access to these spaces, a process that some residents began to do on their own, is a recommended approach. As extracted from the questionnaire, organized and clean spaces reflect the sense of security among residents and provide an inappropriate environment for criminals. Allocating and identifying specific activities for spaces encourage users to use them as intended. It is equally important to allocate open spaces to specific entities to organize and maintain them.

Spaces around mosques are safe during prayer time and vice versa as reported by the questionnaire. The movement to/from mosques (five times along the day) bring life to the area during prayer times and makes residents feel safe. While the lack of pedestrians in between prayer times accompanied by the existence of visual obstacles, according to trace observation, demonstrate the feeling of fear. Vegetation and rearranging visual obstacles, like water tanks and garbage containers, are expected to remedy fields of vision offering a comfortable environment for residents. Identifying areas for labour to gather in at night can keep an eye on the spaces, add courtesy and hence maintain security.

Zone A, the highest crime rate according to the questionnaire, is the most crowded according to behaviour observation and the most accessible and penetrated according to Space Syntax. But, the agreement between residents and strangers' movement is the least. This emphasizes the fact that strangers' presence or movement through the residential area has limited influence on crime when they are accompanied by residents. On contrary, the absence of residents provides an opportunity for crime in spaces mostly accessed by strangers. This is typical with spaces around shops. It is recommended, thus, to reformulate movement routes to drive strangers to routes used by residents (integration core). Otherwise, the integration core could be re-allocated to penetrate the four zones instead of surrounding them; and pass by the commercial zone and mosque in each zone. This is expected to enhance intelligibility across the project encouraging movement on carefully selected spines that are compatible with residents' movement. Zone A, in specific, requires more compatibility between residents and strangers' movement to provide an adequate level of surveillance. The rest of the areas, with low intelligibility values, could be turned into controlled private and semi-private entities to block strangers to navigate through.

Comparing zone, A, the highest crime rate according to the questionnaire, with zone B and D, the least in crime rate, raises the issue of size and population of housing development. Results advocate small scale development with a straightforward urban pattern.

Fear of crime can be generally eliminated by providing sustainable maintenance for the project spaces and movement routes; vegetation can play a significant role herein. Protection tactics justify the low fear of crime achieved in the project despite the recorded crime rate. However, protection tactics need to be studied, examined and developed in integration with the design not imposed on it; this is an interesting future scope of research.

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Conflict of interests

The author declares no conflict of interest.

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Appendix

In a network of potential lines of movement, "connectivity" represents the possible paths that link any two locations. While, "integration" is a measure of closeness-centrality; it identifies the streets that minimize directional or metric distances from all possible destinations. It is a normalized measure of distance from any "a space of origin" to all others in a system. In general, it calculates how close the origin space is to all other spaces and can be seen as the measure of relative asymmetry (or relative depth). Spaces, thus, are arranged from highly integrated (indicated with red) to highly isolated (indicated with blue). Integrated spaces are those easily accessed from everywhere of the project and vice versa. "Integration core" is a pattern made of the 10%, 25% or 50% most integrating spaces. "Intelligibility" represents degree of correlation between connectivity and global integration values of the axial lines in spatial configuration analysis. The high correlation between connectivity and integration ensures that the spatial configuration is understandable and predictable for the pedestrian or vehicular movement. Axial intelligibility indexes the degree to which the number of immediate connections a line has is a reliable guide to the importance of that line in the system as a whole. A strong correlation, or 'high intelligibility', implies that the whole can be read from the parts.
"Choice" measures how likely an axial line or a street segment it is to be passed through on all shortest routes from all spaces to all other spaces in the entire system or within a predetermined distance (radius) from each segment. While, "depth" exists wherever it is necessary to go through intervening spaces to get from one space to another.

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